Annual Review of Physiology
Volume 67, 2005

CONTENTS

Frontispiece—*Michael J. Berridge* xiv

PERSPECTIVES, *Joseph F. Hoffman, Editor*

Unlocking the Secrets of Cell Signaling, *Michael J. Berridge* 1

Peter Hochachka: Adventures in Biochemical Adaptation, *George N. Somero and Raul K. Suarez* 25

CARDIOVASCULAR PHYSIOLOGY, *Jeffrey Robbins, Section Editor*

Calcium, Thin Filaments, and Integrative Biology of Cardiac Contractility, *Tomoyoshi Kobayashi and R. John Solaro* 39

Intracellular Calcium Release and Cardiac Disease, *Xander H.T. Wehrens, Stephan E. Lehnart and Andrew R. Marks* 69

CELL PHYSIOLOGY, *David L. Garbers, Section Editor*

Chemical Physiology of Blood Flow Regulation by Red Blood Cells: The Role of Nitric Oxide and S-Nitrosohemoglobin, *David J. Singel and Jonathan S. Stamler* 99

RNAi as an Experimental and Therapeutic Tool to Study and Regulate Physiological and Disease Processes, *Christopher P. Dillon, Peter Sandy, Alessio Nencioni, Stephan Kissler, Douglas A. Rubinson, and Luk Van Parijs* 147

ECOLOGICAL, EVOLUTIONARY, AND COMPARATIVE PHYSIOLOGY, *Martin E. Feder, Section Editor*

Introduction, *Martin E. Feder* 175

Biophysics, Physiological Ecology, and Climate Change: Does Mechanism Matter? *Brian Helmuth, Joel G. Kingsolver, and Emily Carrington* 177

Comparative Developmental Physiology: An Interdisciplinary Convergence, *Warren Burggren and Stephen Warburton* 203

Molecular and Evolutionary Basis of the Cellular Stress Response, *Dietmar Kültz* 225

ENDOCRINOLOGY, *Bert O'Malley, Section Editor*

Endocrinology of the Stress Response, *Evangelia Charmandari, Constantine Tsigos, and George Chrousos* 259

Lessons in Estrogen Biology from Knockout and Transgenic Animals, *Sylvia C. Hewitt, Joshua C. Harrell, and Kenneth S. Korach* 285

Ligand Control of Coregulator Recruitment to Nuclear Receptors, *Kendall W. Nettles and Geoffrey L. Greene* 309

Regulation of Signal Transduction Pathways by Estrogen and Progesterone, *Dean P. Edwards* 335

GASTROINTESTINAL PHYSIOLOGY, *John Williams, Section Editor*

Mechanisms of Bicarbonate Secretion in the Pancreatic Duct, *Martin C. Steward, Hiroshi Ishiguro, and R. Maynard Case* 377

Molecular Physiology of Intestinal Na^+/H^+ Exchange, *Nicholas C. Zachos, Ming Tse, and Mark Donowitz* 411

Regulation of Fluid and Electrolyte Secretion in Salivary Gland Acinar Cells, *James E. Melvin, David Yule, Trevor Shuttleworth, and Ted Begenisich* 445

Secretion and Absorption by Colonic Crypts, *John P. Geibel* 471

NEUROPHYSIOLOGY, *Richard Aldrich, Section Editor*

Retinal Processing Near Absolute Threshold: From Behavior to Mechanism, *Greg D. Field, Alapakkam P. Sampath, and Fred Rieke* 491

RENAL AND ELECTROLYTE PHYSIOLOGY, *Gerhard H. Giebisch, Section Editor*

A Physiological View of the Primary Cilium, *Helle A. Praetorius and Kenneth R. Spring* 515

Cell Survival in the Hostile Environment of the Renal Medulla, *Wolfgang Neuhofer and Franz-X. Beck* 531

Novel Renal Amino Acid Transporters, *Francois Verrey, Zorica Ristic, Elisa Romeo, Tamara Ramadam, Victoria Makrides, Mital H. Dave, Carsten A. Wagner, and Simone M.R. Camargo* 557

Renal Tubule Albumin Transport, *Michael Gekle* 573

RESPIRATORY PHYSIOLOGY, *Carole R. Mendelson, Section Editor*

Exocytosis of Lung Surfactant: From the Secretory Vesicle to the Air-Liquid Interface, *Paul Dietl and Thomas Haller* 595

Lung Vascular Development: Implications for the Pathogenesis of Bronchopulmonary Dysplasia, *Kurt R. Stenmark and Steven H. Abman* 623

Surfactant Protein C Biosynthesis and Its Emerging Role in Conformational Lung Disease, *Michael F. Beers and Surafel Mulugeta* 663

SPECIAL TOPIC, CHLORIDE CHANNELS, *Michael Pusch, Special Topic Editor*

Cl^- Channels: A Journey for Ca^{2+} Sensors to ATPases and Secondary Active Ion Transporters, *Michael Pusch* 697

Assembly of Functional CFTR Chloride Channels, *John R. Riordan* 701

Calcium-Activated Chloride Channels, *Criss Hartzell, Ilva Putzier, and Jorge Arreola* 719

Function of Chloride Channels in the Kidney, *Shinichi Uchida and Sei Sasaki* 759

Physiological Functions of CLC Cl^- Channels Gleaned from Human Genetic Disease and Mouse Models, *Thomas J. Jentsch, Mallorie Poët, Jens C. Fuhrmann, and Anselm A. Zdebik* 779

Structure and Function of CLC Channels, *Tsung-Yu Chen* 809

INDEXES

Subject Index 841

Cumulative Index of Contributing Authors, Volumes 63–67 881

Cumulative Index of Chapter Titles, Volumes 63–67 884

ERRATA

An online log of corrections to *Annual Review of Physiology* chapters may be found at http://physiol.annualreviews.org/errata.shtml

Subject Index

A

AII-to-cone bipolar synapse
  retinal processing near absolute threshold and, 508–9
A93
  Ca^{2+}-activated Cl^- channels and, 735–37
A-band region
  sarcomere
    calcium and thin filaments in cardiac contractility, 40–49, 58
ABC transporters
  CFTR chloride channels and, 701–12
  CLC channels and, 829
  CLC Cl^- channels and, 779
Absolute threshold
  retinal processing near, 491–510
Absorption
  colonic crypt transport and, 471, 473, 475–76
  intestinal Na^+/H^+ exchange and, 411–12
9-AC
  CLC channels and, 828
Acetazolamide
  bicarbonate secretion in pancreatic duct and, 380, 393–94
Acetylcholine
  bicarbonate secretion in pancreatic duct and, 390
  CLC Cl^- channels and, 779
  salivary gland secretion mechanism and, 454, 457–58
Acinar cells
  salivary gland secretion mechanism and, 445–61
Acrosomes
  estrogen and progesterone signaling, 347–50
Actinomycin D
  estrogen and progesterone signaling, 351
Actins
  calcium and thin filaments in cardiac contractility, 39–41, 44, 46, 48–49, 52–53
  exocytosis of lung surfactant and, 602
  intestinal Na^+/H^+ exchange and, 423, 428–29
  intracellular calcium release channels and cardiac disease, 80
  lung vascular development and, 633
  renal tubule albumin transport and, 578–79
Activation
  Ca^{2+}-activated Cl^- channels and, 726–30
  CFTR chloride channels and, 701–12
  CLC channels and, 819–20
  colonic crypt transport and, 471
  intracellular calcium release channels and cardiac disease, 69, 78
  surfactant protein C in conformational lung disease and, 683–84
Actomyosin
  calcium and thin filaments in cardiac contractility, 43–44, 46
Acute respiratory distress syndrome (ARDS)
  lung vascular development and, 638, 642, 647
Adaptation
  biochemical, 25–89
  cell survival in renal medulla and, 536–37, 544–45
  comparative developmental physiology and, 217
  endocrinology of stress response and, 264–65
Adenosine triphosphate (ATP)
  biochemical adaptation and, 83, 85–86
  cell survival in renal medulla and, 534
  intestinal Na^+/H^+ exchange and, 424
Adenovirus
  RNAi and, 155, 162
Adenylyl cyclase
  Ca^{2+}-activated Cl^- channels and, 720
  salivary gland secretion mechanism and, 459–60
adr genes
  CLC Cl^- channels and, 783
β-Adrenergic receptors
  calcium and thin filaments in cardiac contractility, 50–51, 57
  endocrinology of stress response and, 272
  intracellular calcium

release channels and cardiac disease, 77, 79, 81–82, 84–85
Adrenocorticotropic hormone (ACTH)
endocrinology of stress response and, 268, 271, 273
Adrenomedullary response
endocrinology of stress response and, 263, 265
Aequorins
IP_3 and Ca^{2+} signaling, 13
salivary gland secretion mechanism and, 450
Aerobiosis
biochemical adaptation and, 25
Airway epithelium
Ca^{2+}-activated Cl^- channels and, 724–25
Akt-P13K pathway
lung vascular development and, 647
Alanopine
biochemical adaptation and, 85
Albondin
renal tubule albumin transport and, 579
Albumin
intestinal Na^+/H^+ exchange and, 424
renal tubule transport and, 573–87
Alcohol abuse
endocrinology of stress response and, 267, 269, 273, 276
Aldehyde dehydrogenase
cellular stress response and, 227
Aldosterone
colonic crypt transport and, 473, 476, 479
intestinal Na^+/H^+ exchange and, 420, 422
ALF
exocytosis of lung surfactant and, 599, 605–8
Allopregnenalone
estrogen and progesterone signaling, 346
Allostery
blood flow regulation by red blood cells and, 107–8, 110, 128–30, 136
calcium and thin filaments in cardiac contractility, 39
colonic crypt transport and, 483
estrogen and progesterone signaling, 346–47
intestinal Na^+/H^+ exchange and, 423
Alveolar type 2 cell
surfactant protein C in conformational lung disease and, 663–87
Alveolarization
lung vascular development and, 623–24, 629, 645–47
Alzheimer's disease
RNAi and, 161
Amacrine synapse
retinal processing near absolute threshold and, 507–9
Amiloride
bicarbonate secretion in pancreatic duct and, 383
colonic crypt transport and, 476
intestinal Na^+/H^+ exchange and, 415
primary cilium physiology and, 522
Amino acid transporters
renal, 557–68
Aminoaciduria
renal amino acid transporters and, 557
Amplitude modulation
IP_3 and Ca^{2+} signaling, 13
Amygdala-hippocampus complex
endocrinology of stress response and, 265–66, 270
Amyloidogenesis
surfactant protein C in conformational lung disease and, 685
Amyotrophic lateral sclerosis (ALS)
RNAi and, 161
Anaerobiosis
biochemical adaptation and, 25, 29–30
Anemia
blood flow regulation by red blood cells and, 99, 115, 136
Angiogenesis
lung vascular development and, 623, 625, 628–29, 631–32, 643–46
Angiotensin II
bicarbonate secretion in pancreatic duct and, 389
intestinal Na^+/H^+ exchange and, 424
Anion channels
CLC Cl^- channels and, 779–97
Anion exchangers
bicarbonate secretion in pancreatic duct and, 384, 389–91
Annexins
Ca^{2+}-activated Cl^- channels and, 738
exocytosis of lung surfactant and, 601
Anorexia nervosa
endocrinology of stress response and, 267
Anoxia
biochemical adaptation and, 29–30

Anthracenes
Ca^{2+}-activated Cl^- channels and, 724
CLC channels and, 828
Antioxidants
lung vascular development and, 640
Anxiety disorders
endocrinology of stress response and, 269–70, 273–74, 276–77
Apical membrane
bicarbonate secretion in pancreatic duct and, 386–93
colonic crypt transport and, 471–85
intestinal Na^+/H^+ exchange and, 411–33
Apoptosis
cellular stress response and, 225, 240, 244, 246–47
surfactant protein C in conformational lung disease and, 683–84
Appetite regulation
endocrinology of stress response and, 266
Apportioning regulatory responsibity
comparative developmental physiology and, 208
AP proteins
estrogen biology and, 295
lung vascular development and, 648
renal tubule albumin transport and, 578
Aquaporins
bicarbonate secretion in pancreatic duct and, 386
CLC channels in kidney and, 765–66
colonic crypt transport and, 476
salivary gland secretion mechanism and, 449–51, 454
Arabidopsis thaliana
comparative developmental physiology and, 213
estrogen and progesterone signaling, 353
Arachidonic acid
salivary gland secretion mechanism and, 454, 457–58
ARC channels
salivary gland secretion mechanism and, 457–58
Arginine vasopressin (AVP)
cell survival in renal medulla and, 533, 535, 543
CLC channels in kidney and, 765
endocrinology of stress response and, 259–62, 275
ArKO model
estrogen biology and, 294–95
Artemia spp.
comparative developmental physiology and, 212
Atalopedes campestris
climate change and biophysical ecology, 190
Atherosclerosis
endocrinology of stress response and, 271
Attachment disorder of infancy
endocrinology of stress response and, 267
Autoimmune disorders
endocrinology of stress response and, 259, 275
Autonomic nervous system
endocrinology of stress response and, 272
Autophosphorylation
intracellular calcium release channels and cardiac disease, 77
Axial heterogeneity
renal amino acid transporters and, 558
8-Azido-ATP
CFTR chloride channels and, 705
Azosemide
colonic crypt transport and, 477

B

$B^{0,+}$AT-rBAT heterodimeric exchanger
renal amino acid transporters and, 562–63
B^0AT1 symporter
renal amino acid transporters and, 557, 560–62
Bacteria
CLC channels and, 809, 811–13, 829
colonic crypt transport and, 482
lung vascular development and, 641
Bafilomycin A_1
bicarbonate secretion in pancreatic duct and, 381–82
renal tubule albumin transport and, 582
BAPTA chelator
calcium and thin filaments in cardiac contractility, 43
salivary gland secretion mechanism and, 450
Bartter's syndrome
CLC channels in kidney and, 759, 763, 765, 767–69
CLC Cl^- channels and, 789–90
Barttin protein
CLC channels in kidney

and, 759, 768–69
CLC Cl^- channels and, 781, 787–91, 796
Basic fibroblast growth factor (bFGF)
lung vascular development and, 625
Basolateral amino acid transporters
renal amino acid transporters and, 564–67
Basolateral membrane
bicarbonate secretion in pancreatic duct and, 377, 380–86
colonic crypt transport and, 476–79, 483
BCECF-AM
intestinal Na^+/H^+ exchange and, 423
Berridge MJ, 1–17
Bestrophins
Ca^{2+}-activated Cl^- channels and, 719, 733, 742–43
CLC Cl^- channels and, 780
salivary gland secretion mechanism and, 451–52
Betaine
cell survival in renal medulla and, 538–39
Bicarbonate secretion
colonic crypt transport and, 480
pancreatic duct and
anion exchangers, 384, 389–91
apical membrane mechanisms, 386–93
basolateral membrane mechanisms, 380–86
Ca^{2+}-activated Cl^- channels, 388–89
carbonic anhydrase, 393–94
cation-chloride cotransporters, 384–85
CFTR, 387–88
classical model, 378–79
conclusions, 399
cross-talk, 394–95
H^+-ATPase, 381–82
introduction, 377–80
K^+ channels, 385–86
model refinement, 396–99
Na^+/H^+ exchangers, 380–81, 392
Na^+,K^+-ATPase, 386
segmental differences, 379–80
single-site model, 397–99
SLC26 anion exchangers, 391–92
species, 379–80
technical developments, 379
tv ɔ-site model, 396, 397
w ıter channels, 386
Bidirectional permeation of anions
CFTR chloride channels and, 701–12
Biochemical adaptation
diving, 30–31
exercise, 32–33
facultative anaerobiosis, 29–30
high-altitude adapted humans, 31–32
hydrostatic pressure, 28–29
introduction, 25–27
marine mammals, 30–31
metabolism, 32–33
summary, 33
temperature adaptation of metabolism, 27–28
Biogeography
climate change and biophysical ecology, 177–92
Biophysics
climate change and, 177–92
Biotic communities
climate change and biophysical ecology, 177–92
Bipolar synapse
retinal processing near absolute threshold and, 502–9
Bitopic type II integral membrane protein
surfactant protein C in conformational lung disease and, 663, 671–72
Blood flow regulation
red blood cells and
allostery, 128–30
aspects of blood flow physiology, 101
background, 99–100
biochemistry, 134–35
brain, 103, 105
complexity, 108–10
controversies, 110–12
criticisms, 123–25
disease states, 114
heme, 119–21
heme-to-thiol transfer, 121–22
hybrids, 123
in vitro NO interactions with hemoglobin, 115–25
in vivo NO bioactive compounds, 113–15
introduction, 99–100
linkage, 130–31
lung, 103, 105
mixing methods, 118–19
nitric oxide, 102–3, 113–25, 132–36
nitrite, 126–27
novel intramolecular biochemistry, 121–22
O_2, 133
outlook, 136

oxygen, 128–32
oxy-hemoglobin reaction, 117–18
pathophysiology, 134–35
physiology, 134–35
red blood cells, 102–3, 131
redox, 123
SNO-hemoglobin, 101–2, 104, 107, 115–35
stability, 131
structural effects, 135
superoxide dismutase, 121
thiol-to-heme transfer, 122–24
tissues, 103, 105
vascular effects, 127
vasodilation, 106–7
Blood vessels
lung vascular development and, 523–49
Bombesin
bicarbonate secretion in pancreatic duct and, 384
Bone
CLC Cl^- channels and, 779, 795–96
estrogen and progesterone signaling, 345–46
primary cilium physiology and, 519, 525
renal tubule albumin transport and, 586
Bottlenecks
comparative developmental physiology and, 209
blood flow regulation by red blood cells and, 131
Brain
blood flow regulation by red blood cells and, 103, 105
endocrinology of stress response and, 259–77
Brassinosteroids
estrogen and progesterone signaling, 353
Breast cancer
estrogen biology and, 301–3
estrogen and progesterone signaling, 352–53
ligand control of coregulator recruitment to nuclear receptors and, 310–13, 321–23
BRICHOS domain
surfactant protein C in conformational lung disease and, 675–76, 679
Bronchopulmonary dysplasia
lung vascular development and, 623–24, 637–49
Brush border membrane
intestinal Na^+/H^+ exchange and, 411–33
BSND gene
CLC channels in kidney and, 768
Bubbles
RNAi and, 149
Bumetanide
bicarbonate secretion in pancreatic duct and, 384–85

C

Ca^{2+}
calcium and thin filaments in cardiac contractility, 39–58
colonic crypt transport and, 478–79, 483
exocytosis of lung surfactant and, 598–603
intestinal Na^+/H^+ exchange and, 424
intracellular calcium release channels and cardiac disease, 69–86
IP_3 and Ca^{2+} signaling, 1–17
primary cilium physiology and, 515, 517, 521–23, 525
renal tubule albumin transport and, 583–84
salivary gland secretion mechanism and, 445, 454–58
Ca^{2+}-activated Cl^- channels (CaCC)
activation mechanisms, 726–30
airway epithelium, 724–25
annexins, 738
bestrophin family, 742
bicarbonate secretion in pancreatic duct and, 377–89
CaMKII, 728, 737–38, 741
cardiac excitability, 723
cation permeability, 732–33
CFTR, 738
cGMP-dependent CaCC, 739
ClC-3 channel, 741
CLCA family, 741–42
colonic crypt transport, 478
conclusions, 743
conduction, 731–32
direct gating by Ca^{2+}, 727–29
endothelial cells, 726
exocrine glands, 725
fast block of polyspermy, 725–26
fluid secretion, 724–25
gating, 728
G proteins, 739
intestinal epithelium, 724–25
introduction, 719–20
IP_4, 737
kidney, 726
kinetics of activation, 728

molecular candidates, 740–41
molecular structure, 740–43
neuronal excitability, 722–23
non-selectivity, 730–31
olfactory transduction, 720–21
permeation, 730–34
pH, 739
pharmacology, 734–37
phosphorylation, 728
phototransduction, 722
physiological role, 720–26
pore dimensions, 733
regulation, 737–39
selectivity, 730–34
smooth muscle contraction, 723–24
source of Ca^{2+}, 726–27
taste transduction, 721
tweety, 742
types, 740
Ca^{2+}-induced Ca^{2+} release (CICR)
intracellular calcium release channels and cardiac disease, 69, 80–81, 84
IP_3 and Ca^{2+} signaling, 14–15
Caenorhabditis elegans
CLC channels and, 810
comparative developmental physiology and, 213, 216
intracellular calcium release channels and cardiac disease, 71
primary cilium physiology and, 515, 519, 522, 524
RNAi and, 147–48, 151, 156–57
Caffeine
intracellular calcium release channels and cardiac disease, 74
IP_3 and Ca^{2+} signaling, 6
Calcitonin gene-related peptide (CGRP)
salivary gland secretion mechanism and, 458–59
Calmidazolium
Ca^{2+}-activated Cl^- channels and, 728
calcium and thin filaments in cardiac contractility, 54
Calmodulin
Ca^{2+}-activated Cl^- channels and, 728
exocytosis of lung surfactant and, 601
intracellular calcium release channels and cardiac disease, 72
primary cilium physiology and, 523
Calmodulin kinase II (CaMKII)
Ca^{2+}-activated Cl^- channels and, 728, 737–38, 741
intracellular calcium release channels and cardiac disease, 73–74, 77–78, 80
Calponin
lung vascular development and, 633
Calsequestrin
intracellular calcium release channels and cardiac disease, 74, 79
Calstabins
intracellular calcium release channels and cardiac disease, 69, 73, 76–78, 82, 85–86
cAMP
bicarbonate secretion in pancreatic duct and, 385, 387–88, 392, 395
colonic crypt transport and, 480
estrogen and progesterone signaling, 351, 353
exocytosis of lung surfactant and, 603
intestinal Na^+/H^+ exchange and, 424
intracellular calcium release channels and cardiac disease, 81–82
IP_3 and Ca^{2+} signaling, 1, 3–7, 9–11, 14, 17
renal tubule albumin transport and, 584–85
salivary gland secretion mechanism and, 453, 458–61
Cancer
estrogen biology and, 301–3
estrogen and progesterone signaling, 352–53
ligand control of coregulator recruitment to nuclear receptors and, 310–13, 321–23
Candida albicans
cellular stress response and, 230
salivary gland secretion mechanism and, 446
Carbachol
bicarbonate secretion in pancreatic duct and, 381, 389, 395
salivary gland secretion mechanism and, 457
Carbonic anhydrase
bicarbonate secretion in pancreatic duct and, 377, 393–94
Carboxylic acid
CLC channels and, 828
Carboxy-terminal helix
ligand control of coregulator recruitment to nuclear receptors and, 309–25

Cardiac contractility
calcium and thin filaments in
A-band region of sarcomere, 40–49
Ca^{2+}, 55–58
diastole, 51–55
future research, 58
introduction, 39–40
molecular signaling, 51–58
phosphorylation, 47–48
pressure, 51
relaxation, 54–55
summary, 58
systole, 53–54
thin filaments, 40–49, 55–58
time, 51
tropomyosin, 48–49
troponin C, 42–43
troponin complex, 41–42
troponin I, 44–48
troponin T, 45–48
volume, 51
Cardiac excitability
Ca^{2+}-activated Cl^- channels and, 719, 723
Cardiovascular disease
blood flow regulation by red blood cells and, 99, 115, 136
endocrinology of stress response and, 269, 271
intracellular calcium release channels and, 69–86
Cardiovascular system
estrogen and progesterone signaling, 338–41
Cartilage
primary cilium physiology and, 519, 525
Caspases
surfactant protein C in conformational lung disease and, 683–84
Catalase
lung vascular development and, 640
Catecholamines
endocrinology of stress response and, 259–62, 272, 274
intracellular calcium release channels and cardiac disease, 78, 81
lung vascular development and, 642
Cathepsin D
CLC channels in kidney and, 772
Cation-chloride cotransporters
bicarbonate secretion in pancreatic duct and, 384–85
Cation permeability
Ca^{2+}-activated Cl^- channels and, 732–33
Caveolin
CLC channels in kidney and, 773
estrogen and progesterone signaling, 354–55
cdc genes
estrogen biology and, 296–97, 299
C/EBPβ factor
lung vascular development and, 635–36
Cell cycle checkpoints
cellular stress response and, 242–44
Cell polarization
primary cilium physiology and, 522
Cell proliferation
IP_3 and Ca^{2+} signaling, 1, 17
Cellubrevin
intestinal Na^+/H^+ exchange and, 418
Cellular stress response
apoptosis, 246–47
cell cycle checkpoints, 242–44
conclusions, 247
cross-tolerance, 229–31
DNA damage sensors, 233–36
energy metabolism, 245–46
environmental change, 228–29
functional classification of stress proteins conserved in all cells, 226–28
growth control, 242–44
homeostasis response, 228–30
key functions, 241–42
lipid membrane damage sensors, 231–33
macromolecular damage, 231–41
macromolecular integrity, 244–45
minimal stress proteome of all organisms, 226–31
overview, 225–26
perspective, 247
protein damage sensors, 236–39
redox sensors/redox regulation, 239–41
stress-hardening, 229–31
Central nervous system (CNS)
endocrinology of stress response and, 259–77
estrogen and progesterone signaling, 341–44
primary cilium physiology and, 524
Centrioles
primary cilium physiology and, 516, 518–19
Centrosomes
primary cilium physiology and, 518

Cerebrospinal fluid (CSF)
endocrinology of stress response and, 273
c-*fos* gene
estrogen biology and, 296, 299
Cftr genes
salivary gland secretion mechanism and, 449, 452
cGMP
blood flow regulation by red blood cells and, 128
Ca^{2+}-activated Cl^- channels and, 739
colonic crypt transport and, 480
lung vascular development and, 649
Chaperones
cellular stress response and, 225, 228, 245, 247
CFTR chloride channels and, 701, 709
surfactant protein C in conformational lung disease and, 686
Chemokines
lung vascular development and, 634, 648
Chemosensor
primary cilium physiology and, 515–26
Chemotherapy
estrogen biology and, 301
Chlamydomonas spp.
primary cilium physiology and, 519–20
Chloral hydrate
primary cilium physiology and, 520, 522, 525
2-(*p*-Chlorophenoxy)acetic acid (CPA)
CLC channels and, 828–29
2-(*p*-Chlorophenoxy)butyric acid (CPB)
CLC channels and, 828
2-(*p*-Chlorophenoxy)-propionic acid (CPP)
CLC channels and, 828
Chlorotoxin
Ca^{2+}-activated Cl^- channels and, 737
Cholera toxin
colonic crypt transport and, 477
Cholesterol
ligand control of coregulator recruitment to nuclear receptors and, 321
Chronic adaptation
cell survival in renal medulla and, 536–37
CINC-1 factor
lung vascular development and, 648
Circulation
blood flow regulation by red blood cells and, 99–136
cell survival in renal medulla and, 531–45
lung vascular development and, 623–49
Cl^- channels
bicarbonate secretion in pancreatic duct and, 377, 384–85, 397–99
CLC channels and, 809–31
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
colonic crypt transport and, 471–85
IP_3 and Ca^{2+} signaling, 5–7, 9, 11
renal tubule albumin transport and, 582
salivary gland secretion mechanism and, 446–61
CLC channels
bacterial CLC channels, 811–13, 829
blockers, 827–29
channel conductance, 821, 823
CLC channel family, 810
conclusions, 831
depolarization, 817–19
external Cl^-, 817–20
external H^+, 819–20
fast gating, 817–29
fast-gating mechanisms, 822
gating mechanism of muscle-type CLC channels, 813–20
hyperpolarization-activated fast-gate opening, 819–20
inhibitors, 827–29
internal Cl^-, 820–21
introduction, 809–10
ion channels, 829–31
ion permeation, 821, 823
pores, 825–27
potentials, 825–27
properties, 825–27
slow gating, 814–17
structure/function correlations, 822–29
substituted cysteine accessibility approaches, 824–25
tight coupling, 817–19
transporters, 829–31
vertebrate CLC channels, 813–22
CLC Cl^- channels
ClC-1, 782–84
ClC-2, 784–87
ClC-3, 790–91
ClC-5, 792–94
ClC-K/Barttin, 787–90
endosomal Cl^- channel, 790–92
general properties, 780–82
introduction, 779–80
kidney and β-subunit of ClC-K channels, 768–69

Bartter's syndrome, 767–68
Barttin, 768–69
CLC-5 Cl^- channel, 769–71
CLC Cl^- channels expressed in kidney, 760–61
ClC-K Cl^- channels, 761–73
ClC-K1 knockout mice, 764–66
cloning, 761–62
fish, 767
intrarenal localization, 761–62
introduction, 759–60
non-CLC Cl^- channels, 773
postnatal development of ClC-K1, 766–67
rat ClC-K1, 762–64
myotonia, 782–84
outlook, 796–97
renal endocytosis, 792–94
salt transport in kidney and inner ear, 787–90
summary, 796–97
synaptic vesicles, 790–92
vesicular channel, 792–94
CLC genes
Ca^{2+}-activated Cl^- channels and, 741–42
salivary gland secretion mechanism and, 449, 452–53, 461
Climate change
biophysics and physiological ecology
biophysics, 180–81
insect responses, 187–91
introduction, 177–80
measuring environment, 180–81
population responses, 179–80
rocky intertidal zone, 181–87
rocky shore communities, 184–87
shifting wave climate, 184–87
species range limits, 181–87
species responses, 179–80
Clofibric acid
CLC channels and, 828
Clonidine
endocrinology of stress response and, 269
Clostridium difficile
intestinal Na^+/H^+ exchange and, 428
c-*mos* gene
estrogen and progesterone signaling, 350
Colchicine
bicarbonate secretion in pancreatic duct and, 381
exocytosis of lung surfactant and, 602
Colonic crypts
secretion and absorption by
absorption, 473, 475–76
apical K channels, 479
bacterial toxins, 482
basolateral Cl channels, 478–79
bicarbonate secretion, 480
calcium-activated Cl channels, 478
cAMP-dependent secretion, 480
cell types, 472
CFTR, 477
cGMP-dependent secretion, 480
Cl^- channels, 477
colonic epithelium anatomy, 472–74
electrogenic absorption, 475–78
electroneural NaCl absorption, 473–74, 478
inflammatory bowel disease, 482
intermediate conductance Cl channels, 477–78
introduction, 471–72
Na/H exchange, 475
NKCC cotransport, 476–77
novel transport modulation, 483
pathological modifications of ion transport, 481–82
potassium channels, 479
regulated ion secretion, 480–81
secretion, 476–84
secretory diarrhea, 482
summary, 485
surface vs crypt ion transport, 472–73
Comparative developmental physiology
animal models, 213–15
apportioning regulatory responsibity, 208
biochemical adaptation, 25–33
current themes, 207–17
definition, 203–6
developmental fitness, 209–10
diversity, 213–15
environment, 208–9
event sequences, 212–13
evolution, 209–11
experimental approaches, 211
genetic engineering, 216
imaging, 215–16
methodologies, 211
miniaturization, 215
positioning within

biology, 206–7
scaling, 211–12
technologies for investigating, 215–16
unanswered questions, 216–17
universal mechanisms, 213–15
Compound exocytosis
exocytosis of lung surfactant and, 604–5
Conduct disorders
endocrinology of stress response and, 276
Cone bipolar-to-ganglion cell synapse
retinal processing near absolute threshold and, 508–9
Conformational lung disease
surfactant protein C and, 663–87
Conformational maturation
CFTR chloride channels and, 709–10
Congenital abnormalities
intestinal Na^+/H^+ exchange and, 432
Congo Red
surfactant protein C in conformational lung disease and, 686
connexin genes
estrogen biology and, 299
Contractility
Ca^{2+}-activated Cl^- channels and, 723, 724
calcium and thin filaments in cardiac contractility, 39
intracellular calcium release channels and cardiac disease, 69, 78–82, 86
IP_3 and Ca^{2+} signaling, 17
Converging signals
estrogen biology and, 299–301
Convertase
exocytosis of lung surfactant and, 609
COOH domain
surfactant protein C in conformational lung disease and, 677–78, 680
Cooperative mechanisms
calcium and thin filaments in cardiac contractility, 39
Coregulation
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Corticotropin-releasing hormone (CRH)
endocrinology of stress response and, 259–62, 266–75, 277
Cortisol
endocrinology of stress response and, 271, 273–75
Coupled gating
intracellular calcium release channels and cardiac disease, 78
COUP-TFII
lung vascular development and, 633
CRAC channels
salivary gland secretion mechanism and, 457
Critical photoperiod
climate change and biophysical ecology, 191
Crossbridges
calcium and thin filaments in cardiac contractility, 40–41, 51–55, 58
Cross-talk
bicarbonate secretion in pancreatic duct and, 394–95
cell survival in renal medulla and, 533
estrogen biology and, 298
salivary gland secretion mechanism and, 458–60
Cross-tolerance
cellular stress response and, 229–31
Cubilin
renal tubule albumin transport and, 573, 576, 580–83
Curcumin
surfactant protein C in conformational lung disease and, 686
Cushing's syndrome
endocrinology of stress response and, 267, 271, 273
CXCR2 receptor
lung vascular development and, 648
Cx genes
estrogen biology and, 299
lung vascular development and, 633–34
Cyclins
estrogen and progesterone signaling, 350
estrogen biology and, 296–97, 299
Cyclophilins
cellular stress response and, 245
estrogen biology and, 299
Cyclosporin A
cellular stress response and, 245
Cystic fibrosis transmembrane regulator (CFTR)
bicarbonate secretion in pancreatic duct and, 377, 386–96, 398–99
Ca^{2+}-activated Cl^- channels and, 719, 724–26, 732–34, 738
chloride channels

CFTR interactions with other proteins, 710–12
CFTR synthesis, 709–10
conformational maturation, 709–10
domain assembly, 709–10
functional macromolecular complexes, 710–12
hypothetical model of CFTR channel action, 702–4
introduction, 701–2
quaternary structure of CFTR channel action, 704–9
CLC channels and, 829
CLC channels in kidney and, 759, 772
CLC Cl^- channels and, 779, 787
colonic crypt transport and, 475–83
intestinal Na^+/H^+ exchange and, 416
renal tubule albumin transport and, 582
salivary gland secretion mechanism and, 449, 452
surfactant protein C in conformational lung disease and, 679, 685–86
Cystinuria transporter
renal amino acid transporters and, 557, 562–63
Cytochalasin D
bicarbonate secretion in pancreatic duct and, 382
exocytosis of lung surfactant and, 602
Cytokines
endocrinology of stress response and, 270, 272
lung vascular development and, 641
Cytomegalovirus (CMV)
RNAi and, 153, 159
Cytoplasmic domains
intracellular calcium release channels and cardiac disease, 69, 73, 79, 84
surfactant protein C in conformational lung disease and, 678
Cytoskeleton
intestinal Na^+/H^+ exchange and, 423, 428–29

D

Dacyl-ureas
acidic Ca^{2+}-activated Cl^- channels and, 737
Danio rerio
comparative developmental physiology and, 213, 216
DEA-NO
blood flow regulation by red blood cells and, 119, 121, 135
Dehydration
colonic crypt transport and, 483
Dent's disease
CLC Cl^- channels and, 793–94, 796
Dephosphorylation
intracellular calcium release channels and cardiac disease, 74, 78, 82
Depolarization
CLC channels and, 817–19
Depression
endocrinology of stress response and, 267, 269–70, 272, 274, 276–77
Detoxification
blood flow regulation by red blood cells and, 133
Development
CLC channels in kidney and, 766–67
comparative developmental physiology and, 203–17
endocrinology of stress response and, 267–69, 275–77
lung vascular development and, 623–49
primary cilium physiology and, 515–26
RNAi and, 148–49
Dextran
renal tubule albumin transport and, 577
DHR38 orphan nuclear receptor
ligand control of coregulator recruitment to nuclear receptors and, 320
Diabetes
blood flow regulation by red blood cells and, 99, 115, 136
CLC channels in kidney and, 759, 764–66
endocrinology of stress response and, 267, 271
intracellular calcium release channels and cardiac disease, 81
renal tubule albumin transport and, 586
Diacylglycerol (DAG)
exocytosis of lung surfactant and, 602
IP_3 and Ca^{2+} signaling, 8–9, 11, 13
Diarrhea
colonic crypt transport and, 471–72, 476, 481–83, 485
intestinal Na^+/H^+ exchange and, 411–12
Diastole
calcium and thin filaments in cardiac contractility, 51–55, 57

intracellular calcium release channels and cardiac disease, 74, 79, 85
Dicer genes
RNAi and, 149–50, 153
3′,5-Dichlorodiphenylamine-2-carboxylic acid (DCDPC)
Ca^{2+}-activated Cl^- channels and, 721
N,N′-Dicyclohexyl-carbodiimide (DCCD)
bicarbonate secretion in pancreatic duct and, 382
DIDS
bicarbonate secretion in pancreatic duct and, 388, 390–91
Ca^{2+}-activated Cl^- channels and, 735–37, 740
Diethylstilbestrol (DES)
ligand control of coregulator recruitment to nuclear receptors and, 314, 321
Digestion
intestinal Na^+/H^+ exchange and, 411–33
Dihydropteridine reductase (DHPR)
intracellular calcium release channels, 84
4,4′-Diisothiocyano-2,2′-stilbenedisulfonate (DIDS)
CLC channels and, 828
Dilated cardiomyopathy
calcium and thin filaments in cardiac contractility, 55
Dimerization
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Dimethylbenzanthracene (DMBA)
estrogen biology and, 302
Dimethylsulfoxide (DMSO)
surfactant protein C in conformational lung disease and, 686
Dipalmitoylphosphatidyl-choline (DPPC)
exocytosis of lung surfactant and, 596
Dip frequency
calcium and thin filaments in cardiac contractility, 55
Diphenylcarboxylate (DPC)
bicarbonate secretion in pancreatic duct and, 387
Ca^{2+}-activated Cl^- channels and, 735–37
CFTR chloride channels and, 706
Diphosphoglycerate (DPG)
blood flow regulation by red blood cells and, 109
Diphosphopyridine nucleotide (DPN)
ligand control of coregulator recruitment to nuclear receptors and, 319
Direct gating
Ca^{2+}-activated Cl^- channels and, 727–29
Diuresis
cell survival in renal medulla and, 531–45
Diversity
comparative developmental physiology and, 213–16
DMPK gene
CLC Cl^- channels and, 784
DNA damage
cell survival in renal medulla and, 537
cellular stress response and, 225, 233–36
Domain assembly
CFTR chloride channels and, 709–10
Dominant-negative effect
surfactant protein C in conformational lung disease and, 681
Dopamine
intestinal Na^+/H^+ exchange and, 424
Drosha genes
RNAi and, 149–50, 153
Drosophila melanogaster
Ca^{2+}-activated Cl^- channels and, 742
cellular stress response and, 228–29
intracellular calcium release channels and cardiac disease, 71
lung vascular development and, 635–36
RNAi and, 147, 156–57
salivary gland secretion mechanism and, 457
Duodenum
intestinal Na^+/H^+ exchange and, 416
Dynein
primary cilium physiology and, 517, 520
Dyslipidemia
endocrinology of stress response and, 269, 271

E

EAAT3 (EAAC1) luminal Na^+-dependent cotransporter
renal amino acid transporters and, 563–64
Eating disorders
endocrinology of stress response and, 267, 269, 276
Ecology
climate change and biophysical ecology, 177–92
Electrogenic absorption

bicarbonate secretion in pancreatic duct and, 377
colonic crypt transport and, 475–76, 478
Electrolyte transport
Ca^{2+}-activated Cl^- channels and, 719–43
colonic crypt transport and, 471–85
salivary gland secretion mechanism and, 445–61
Electron paramagnetic resonance (EPR)
blood flow regulation by red blood cells and, 113–14, 124, 127
Electroneural NaCl absorption
colonic crypt transport and, 473–74, 478
Electroretinograms (ERGs)
retinal processing near absolute threshold and, 505–6
EMAP-2 protein
lung vascular development and, 634
ENaC channel
colonic crypt transport and, 473, 475–76, 478
Endocrinology
stress response and, 259–77
Endocytosis
CLC Cl^- channels and, 779, 792–94, 797
renal tubule albumin transport and, 573, 576–79, 583
Endoplasmic reticulum
CFTR chloride channels and, 701, 709
intracellular calcium release channels and cardiac disease, 69
IP_3 and Ca^{2+} signaling, 11, 13–14
surfactant protein C in conformational lung disease and, 671–72, 683
β-Endorphin
endocrinology of stress response and, 259, 268
Endosomes
CLC Cl^- channels and, 779, 790–95
renal tubule albumin transport and, 577, 579, 581–83, 585
surfactant protein C in conformational lung disease and, 676, 684–86
Endothelial NO synthase (eNOS)
lung vascular development and, 646–47, 649
Endothelins
intestinal Na^+/H^+ exchange and, 424
Endothelium-derived relaxing factor (EDRF)
blood flow regulation by red blood cells and, 106, 128, 134, 136
End systolic pressure
calcium and thin filaments in cardiac contractility, 51, 53, 56–57
Enhanced green fluorescent protein (EGFP)
surfactant protein C in conformational lung disease and, 679–80
Environment
cellular stress response and, 225–47
climate change and biophysical ecology, 177–92
comparative developmental physiology and, 208–9
endocrinology of stress response and, 275–77
Ephrin
lung vascular development and, 633
Epidermal growth factor (EGF)
estrogen biology and, 298, 300
intestinal Na^+/H^+ exchange and, 421
lung vascular development and, 625, 631
salivary gland secretion mechanism and, 446
Epilepsy
CLC Cl^- channels and, 785–86
Epinephrine
endocrinology of stress response and, 259
intestinal Na^+/H^+ exchange and, 424
Epithelial transport
bicarbonate secretion in pancreatic duct and, 377
Ca^{2+}-activated Cl^- channels and, 719–43
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
colonic crypt transport and, 472–74
renal amino acid transporters and, 557–68
ER-associated degradation (ERAD)
surfactant protein C in conformational lung disease and, 683
erbB2 gene
estrogen biology and, 301
ERKO model
estrogen biology and, 288–93, 298–302
Erythropoietin
blood flow regulation by red blood cells and, 136
lung vascular development

and, 636
Escherichia coli
cellular stress response and, 226, 235, 242, 244–45
CLC channels and, 809, 811, 829
colonic crypt transport and, 477, 482
Esophagus
intestinal Na^+/H^+ exchange and, 416
Estrogen
endocrinology of stress response and, 271
ligand control of coregulator recruitment to nuclear receptors and, 310–16, 319–24
Estrogen and progesterone signaling
allosteric modulators, 346–47
bone, 345–46
cardiovascular system, 338–41
cell membrane, 354–57
CNS, 341–44
coupling with signal pathways, 357–62
endocrine pancreas, 344
estrogen target tissues, 344–46
$GABA_A$, 346–47
gene transcription, 336–37
germ cell maturation, 347–54
introduction, 335–36
macrophages, 344–45
oocyte maturation, 350–53
ovarian granulosa cells, 354
oxytocin receptors, 346–47
progesterone/progesterone metabolites, 341, 346–47
rapid extranuclear and nuclear signaling, 362–64
signal transduction, 341–44
sperm cell acrosome reaction, 347–50
steroid hormones, 336–38
steroid receptor localization, 354–57
subcellular targeting, 357
summary, 364–66
triggering responses, 357–62
Estrogen biology
knockout and transgenic animals
AP-1 tethered mode of ER signaling, 295
ArKO, 294–95
breast cancer models, 301–3
converging signals, 299–301
ER, 301–3
ERβ, 293–94
ER-growth factor cross talk, 298
ER-null environment, 294–95
ERKO model, 288–94, 298
estrogen-free environment, 294–95
estrogen receptor molecule, 285–87
implantation-associated signals, 299
male fertility, 293
mechanisms, 285–87, 295–97
mouse models, 287–88, 295–97
NERK1, 295
ovary, 292–93
PRKO model, 288–92
structures, 285–87
summary, 303
N-Ethylmaleimide
bicarbonate secretion in pancreatic duct and, 382
"Evo-devo" paradigm
comparative developmental physiology and, 210–11
Evolution
cellular stress response and, 225–47
comparative developmental physiology and, 203–17
Excitability
Ca^{2+}-activated Cl^- channels and, 719, 722–23
Excitation-contraction (EC) coupling
intracellular calcium release channels and cardiac disease, 69, 78–82, 86
Exercise
endocrinology of stress response and, 267, 273
Exocrine glands
Ca^{2+}-activated Cl^- channels and, 725
Exocytosis
CLC Cl^- channels and, 795
lung surfactant and
ALF, 605–8
Ca^{2+}, 598–603
Ca^{2+}-independent pathways, 602–3
compound exocytosis, 604–5
convertase, 609
cycling, 608–9
fusion pore expansion, 603–4, 606–7
introduction, 595–612
lamellar body fusion, 598, 601–5
mechanistic model, 601–2
modes of stimulation, 597–98
post-fusion phase, 603–4

prefusion phase, 597–603
sensors, 601
steps within exocytotic process, 597
summary, 611–12
surfactant secretion and turnover, 596
transient fusion, 604
tubular myelin, 610–11
surfactant protein C in conformational lung disease and, 663–87
Expression analysis
surfactant protein C in conformational lung disease and, 679–80

F

Facilitated diffusion
renal amino acid transporters and, 564–65
Facultative anaerobiosis
biochemical adaptation and, 29–30
Familial hypertrophic cardiomyopathy
calcium and thin filaments in cardiac contractility, 55
Farglitazar
ligand control of coregulator recruitment to nuclear receptors and, 322
Fast block of polyspermy
Ca^{2+}-activated Cl^- channels and, 725–26
Fast gating
CLC channels and, 817–29
Fertilization
IP_3 and Ca^{2+} signaling, 1, 17
Fetal programming
comparative developmental physiology and, 203, 209–10
Fibroblast growth factor (FGF)
lung vascular development and, 625, 635, 648
Fibronectin
primary cilium physiology and, 525
Fibrosis
renal tubule albumin transport and, 573, 586–87
Field physiology
climate change and biophysical ecology, 177–92
Fight or flight response
intracellular calcium release channels and cardiac disease, 69
FiO_2
lung vascular development and, 639, 647, 649
Fitness
comparative developmental physiology and, 209–10
FK506
intracellular calcium release channels and cardiac disease, 82
FKBP12/FKBP12.6
intracellular calcium release channels and cardiac disease, 69, 73
Flow sensing
primary cilium physiology and, 520–22
Flufenamic acid
Ca^{2+}-activated Cl^- channels and, 721, 737
Fluids
Ca^{2+}-activated Cl^- channels and, 719–43
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
colonic crypt transport and, 471–85
intestinal Na^+/H^+ exchange and, 411–33
salivary gland secretion mechanism and, 445–61
Fluoxetine
Ca^{2+}-activated Cl^- channels and, 737
Flutamide
ligand control of coregulator recruitment to nuclear receptors and, 313
Foreign compartments
surfactant protein C in conformational lung disease and, 684–85
forkhead gene
lung vascular development and, 636
Forskolin
bicarbonate secretion in pancreatic duct and, 382, 384, 390, 395
colonic crypt transport and, 483
renal tubule albumin transport and, 584
salivary gland secretion mechanism and, 459
Förster resonance energy transfer (FRET)
calcium and thin filaments in cardiac contractility, 40–41, 44
fox genes
lung vascular development and, 632
Frank-Starling mechanism
calcium and thin filaments in cardiac contractility, 39, 56–57
Free amino acids
cell survival in renal medulla and, 540
Frequency modulation
IP_3 and Ca^{2+} signaling, 13–14
Fumagillin
lung vascular development

and, 645
Functional conservation
cellular stress response and, 226–28
Functional macromolecular complexes
CFTR chloride channels and, 710–12
Functional network of genes
cell survival in renal medulla and, 542–44
Furosemide
bicarbonate secretion in pancreatic duct and, 385
colonic crypt transport and, 477
Fusion pore
exocytosis of lung surfactant and, 595–12

G

$GABA_A$
CLC Cl^- channels and, 759, 779
estrogen and progesterone signaling, 346–47
Gain-of-function mutations
intracellular calcium release channels and cardiac disease, 85
surfactant protein C in conformational lung disease and, 680–81, 686
Gallbladder
intestinal Na^+/H^+ exchange and, 418
Gallus gallus
comparative developmental physiology and, 213
Ganglion cells
retinal processing near absolute threshold and, 491–510
Gastrointestinal (GI) tract
endocrinology of stress response and, 272
"functional" endocrinology of stress response and, 267
intestinal Na^+/H^+ exchange and, 411–33
Gating
Ca^{2+}-activated Cl^- channels and, 727–29
CFTR chloride channels and, 701–12
CLC channels and, 813–29
CLC Cl^- channels and, 779, 792
exocytosis of lung surfactant and, 599
intracellular calcium release channels and cardiac disease, 78
Gd^{3+}
colonic crypt transport and, 483
exocytosis of lung surfactant and, 600
primary cilium physiology and, 522
Gene silencing
RNAi and, 150–53
Gene transcription
estrogen and progesterone signaling, 335–66
Genetic engineering
comparative developmental physiology and, 203, 216
Genetic screens
RNAi and, 156–59
Genomics
cellular stress response and, 242, 245
CLC channels in kidney and, 773
comparative developmental physiology and, 203–17
surfactant protein C in conformational lung disease and, 664–66
Germ cell maturation
estrogen and progesterone signaling, 347–54
Glibenclamide
bicarbonate secretion in pancreatic duct and, 388
Global climate change
climate change and biophysical ecology, 177–92
Glomerular filtration
renal tubule albumin transport and, 574–79
Glucocorticoids
colonic crypt transport and, 479
endocrinology of stress response and, 259, 267–73
intestinal Na^+/H^+ exchange and, 424, 431–33
GLUT2 transporter
renal amino acid transporters and, 557, 564
Glutamate
CLC channels and, 811–12, 827, 829–30
CLC channels in kidney and, 763
retinal processing near absolute threshold and, 506
Glutathione (GSH)
blood flow regulation by red blood cells and, 123, 128–29
cellular stress response and, 240
Glutathione peroxidase
lung vascular development and, 640
Glutathione reductase
cellular stress response and, 227
Glycerol
surfactant protein C in conformational lung disease and, 686
Glycerol-3-phosphate

dehydrogenase
cellular stress response and, 227
Glycerophosphorylcholine
cell survival in renal medulla and, 537–38
Glycine hydrazine
Ca^{2+}-activated Cl^- channels and, 737
Glycine receptor
CLC Cl^- channels and, 779
Glycinergic synapse
retinal processing near absolute threshold and, 501–2, 508
G protein-coupled cell membrane receptors
colonic crypt transport and, 483
G proteins
Ca^{2+}-activated Cl^- channels and, 739
renal tubule albumin transport and, 583–84
retinal processing near absolute threshold and, 506
salivary gland secretion mechanism and, 453
Granulosa cells
ovarian
estrogen and progesterone signaling, 354
Green fluorescent protein (GFP)
RNAi and, 158
Growth
cellular stress response and, 242–44
endocrinology of stress response and, 267–69
Growth factors
estrogen biology and, 298
lung vascular development and, 630–34
Growth hormone (GH)
endocrinology of stress response and, 267–69, 271
Growth hormone-releasing hormone (GHRH)
endocrinology of stress response and, 268
GW0072
ligand control of coregulator recruitment to nuclear receptors and, 314

H

H^+
CLC channels and, 809, 819–20
CLC Cl^- channels and, 793
intestinal Na^+/H^+ exchange and, 411–33
H^+-ATPase
bicarbonate secretion in pancreatic duct and, 377, 381–82
H^+-cotransporter
renal amino acid transporters and, 562
H_2DIDS
bicarbonate secretion in pancreatic duct and, 382–83, 390
Hair trigger
CFTR chloride channels and, 704
Halobacterium spp.
cellular stress response and, 226
Hartnup disorder
renal amino acid transporters and, 557, 560
HB-EGF
lung vascular development and, 625
Heart
blood flow regulation by red blood cells and, 99, 115, 136
calcium and thin filaments in cardiac contractility, 39–58
intracellular calcium release channels and cardiac disease, 69
Heat exchange
climate change and biophysical ecology, 177–92
Heat shock proteins
cell survival in renal medulla and, 531–45
Helix 12
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Heme
blood flow regulation by red blood cells and, 119–24
Hemoglobin
blood flow regulation by red blood cells and, 99–136
Hepatitis virus
RNAi and, 159, 161
Hepatocyte nuclear factor (HNF)
lung vascular development and, 636
Heterochrony
comparative developmental physiology and, 203, 212–13
Heterokairy
comparative developmental physiology and, 203, 212
Hex genes
lung vascular development and, 634
Hg^{2+}
bicarbonate secretion in pancreatic duct and, 386
HIF1α factor

lung vascular development and, 635–36
High-altitude adapted humans
biochemical adaptation and, 31–32
Hippocampus
CLC Cl^- channels and, 790
endocrinology of stress response and, 265–66, 269–70
Hochachka P
in memoriam, 25–33
HOE694
bicarbonate secretion in pancreatic duct and, 381, 392
Hole binding
blood flow regulation by red blood cells and, 123
Homeostasis
cellular stress response and, 228–30
colonic crypt transport and, 471–85
Homomeric association
surfactant protein C in conformational lung disease and, 675
Hox genes
comparative developmental physiology and, 213
lung vascular development and, 634
HPTE
ligand control of coregulator recruitment to nuclear receptors and, 319
hTTTY genes
Ca^{2+}-activated Cl^- channels and, 742–43
Human immunodeficiency virus (HIV)
RNAi and, 159, 161
Humoral immunity
endocrinology of stress response and, 272
Huntington's disease
RNAi and, 161
surfactant protein C in conformational lung disease and, 686
Hydrolyzable ligand-gated channel
CFTR chloride channels and, 701–12
Hydrostatic pressure
biochemical adaptation and, 25, 28–29
Hydroxide
cellular stress response and, 240
2-Hydroxyacid dehydrogenase
cellular stress response and, 227
Hydroxyacylglutathione hydrolase
cellular stress response and, 227
20-Hydroxyeicosatetraenoic acid (20-HETE)
cell survival in renal medulla and, 533–34
5-Hydroxytryptamine (5-HT)
bicarbonate secretion in pancreatic duct and, 389
IP_3 and Ca^{2+} signaling, 3–9, 11–12
Hyperactivation
endocrinology of stress response and, 266–75
Hypercoagulation
endocrinology of stress response and, 271
Hyperosmolarity
intestinal Na^+/H^+ exchange and, 424
Hyperphosphorylation
intracellular calcium release channels and cardiac disease, 82
Hyperpolarization
CLC channels and, 819–20
Hypertension
blood flow regulation by red blood cells and, 115, 136
endocrinology of stress response and, 269, 271
lung vascular development and, 623, 632, 639, 642–43, 646–47, 649
renal tubule albumin transport and, 586
Hyperthyroidism
endocrinology of stress response and, 267, 273
Hypertonicity
cell survival in renal medulla and, 542–44
Hypertrophic cardiomyopathy
calcium and thin filaments in cardiac contractility, 55
Hypoactivation
endocrinology of stress response and, 274–75
Hypotension
blood flow regulation by red blood cells and, 133, 135
Hypothalamic-pituitary-adrenal (HPA) axis
endocrinology of stress response and, 260, 262–63, 267, 269, 271–75, 277
Hypothalamus
CLC channels in kidney and, 765
Hypothyroidism
endocrinology of stress response and, 274
Hypotonic swelling
exocytosis of lung surfactant and, 600
Hypoxia
biochemical adaptation and, 25, 29

cell survival in renal medulla and, 531–45
comparative developmental physiology and, 209, 212–13
Hypoxic vasodilation
blood flow regulation by red blood cells and, 99–136

I

IAANS probe
calcium and thin filaments in cardiac contractility, 43
ICI-182,780
estrogen biology and, 297–300
ligand control of coregulator recruitment to nuclear receptors and, 312
IFT88 gene
primary cilium physiology and, 519
Ileum
intestinal Na^+/H^+ exchange and, 417
Immune response
endocrinology of stress response and, 272–75
Immunoglobulin A (IgA)
salivary gland secretion mechanism and, 446
Immunomodulation
surfactant protein C in conformational lung disease and, 681–82
Impaired adaptation
cell survival in renal medulla and, 544–45
Implantation-associated signals
estrogen biology and, 299
Indanyloxyacetic acid
Ca^{2+}-activated Cl^- channels and, 724
Indirect antagonism
ligand control of coregulator recruitment to nuclear receptors and, 313–14
Indomethacin
Ca^{2+}-activated Cl^- channels and, 739
Inducible nitric oxide synthase (iNOS)
lung vascular development and, 636
Induction
estrogen and progesterone signaling, 350–53
RNAi and, 151, 154–55
Infants
endocrinology of stress response and, 259, 267
lung vascular development and, 623–24, 637–49
Infection
colonic crypt transport and, 472
Inflammatory bowel disease (IBD)
colonic crypt transport and, 482
Inflammatory response
intestinal Na^+/H^+ exchange and, 432–33
renal tubule albumin transport and, 573, 586–87
Influenza virus
RNAi and, 160–61
Information processing
IP_3 and Ca^{2+} signaling, 1
Inhibitors
CLC channels and, 827–29
Inner ear
CLC Cl^- channels and, 787–90
Inositol 3,4,5,6-tetrakisphosphate (IP_4)
Ca^{2+}-activated Cl^- channels and, 737
Inositol 1,4,5-triphosphate (IP_3)
intracellular calcium release channels and cardiac disease, 69
IP_3 and Ca^{2+} signaling, 1–17
salivary gland secretion mechanism and, 445
Insects
climate change and biophysical ecology, 177, 187–91
IP_3 and Ca^{2+} signaling, 1–6, 8, 10, 15
Insulin
endocrinology of stress response and, 267–69, 271, 276
intestinal Na^+/H^+ exchange and, 424
ligand control of coregulator recruitment to nuclear receptors and, 322
Insulin-like growth factor-1 (IGF-1)
endocrinology of stress response and, 268–69, 271
estrogen biology and, 298, 300
Integrative biology
calcium and thin filaments in cardiac contractility, 39–58
Integrins
lung vascular development and, 634
primary cilium physiology and, 524–25
Interdisciplinary convergence
comparative developmental physiology and, 203
Interferon (IFN)
RNAi and, 153–54
Interferon γ (IFNγ)
endocrinology of stress response and, 273

intestinal Na^+/H^+ exchange and, 422
lung vascular development and, 634
Interleukins (ILs)
endocrinology of stress response and, 270, 272–73
intestinal Na^+/H^+ exchange and, 422
lung vascular development and, 639, 641, 648
Intermediate conductance Cl channels
colonic crypt transport and, 477–78
Interneurons
retinal processing near absolute threshold and, 501–2, 504–9
Interstitial lung disease
surfactant protein C in conformational lung disease and, 675–81, 686–87
Intertidal zone
climate change and biophysical ecology, 181–87
Intestinal epithelium
Ca^{2+}-activated Cl^- channels and, 724–25
colonic crypt transport and, 471–85
Intracellular calcium release channels
cardiac disease and
calcium release units, 79, 83–84
calmodulin, 72
calstabins, 73, 76, 78
CaMKII, 78, 80
cytoplasm, 79, 84
dephosphorylation, 78
diastole, 79
excitation-contraction coupling in normal heart, 78–81
introduction, 69–71
kinases, 73–74, 79–81
leaky channels, 82–83
luminal-binding partners, 74
macromolecular complex, 72–74
pathogenesis of altered Ca^{2+} signaling in heart failure, 81–85
phosphatases, 73–74, 78–81
phosphorylation, 74–76, 78–81
PP2A, 80–81
PPI, 80–81
protein kinase A, 74–76, 79–80
ryanodine receptors, 71–78, 82–83
sorcin, 74
structure/function relationships, 71–74
summary, 85–86
systole, 78–79
triggered arrhythmias in heart failure, 85
Intracellular isoforms
intestinal Na^+/H^+ exchange and, 411–33
Intraciliary transport
primary cilium physiology and, 519–20
Intrarenal localization
CLC channels in kidney and, 761–62
Inulin
renal tubule albumin transport and, 577
Inversin
primary cilium physiology and, 523
inv gene
primary cilium physiology and, 517–18
Ion channels
Ca^{2+}-activated Cl^- channels and, 719–43
CLC channels and, 809, 821, 823, 829–31
colonic crypt transport and, 471–85
salivary gland secretion mechanism and, 445, 448–53
Ionomycin
bicarbonate secretion in pancreatic duct and, 389
Ca^{2+}-activated Cl^- channels and, 725, 728
IP-10 protein
lung vascular development and, 634
Ischemia
blood flow regulation by red blood cells and, 136
Isocitrate dehydrogenase
cellular stress response and, 227
Isoproterenol
calcium and thin filaments in cardiac contractility, 50–51, 57
salivary gland secretion mechanism and, 459
I-Z-I region
sarcomere
calcium and thin filaments in cardiac contractility, 58

J

jagged gene
lung vascular development and, 632–33
Jejunum
intestinal Na^+/H^+ exchange and, 417
Junctin
intracellular calcium release channels and cardiac disease, 74, 79

K

K^+ channels
bicarbonate secretion in pancreatic duct and, 385–86
Ca^{2+}-activated Cl^- channels and, 730–31, 733–34
CLC Cl^- channels and, 789–90
colonic crypt transport and, 478–79
IP_3 and Ca^{2+} signaling, 5–7, 9, 11
primary cilium physiology and, 522
salivary gland secretion mechanism and, 460–61
Kallikrein
salivary gland secretion mechanism and, 446
Kcn genes
salivary gland secretion mechanism and, 449, 453
Kidney
Ca^{2+}-activated Cl^- channels and, 726
cell survival in renal medulla and, 531–45
CLC channels in, 759–73
CLC Cl^- channels and, 787–90
primary cilium physiology and, 515–26
renal amino acid transporters and, 557–68
renal tubule albumin transport and, 573–87
KIF proteins
primary cilium physiology and, 517, 520
Kinases
intracellular calcium release channels and cardiac disease, 69, 73–74, 79–81
surfactant protein C in conformational lung disease and, 683
Kinesins
primary cilium physiology and, 517, 519–20
Kinetic bottlenecks
blood flow regulation by red blood cells and, 131
KN-62
Ca^{2+}-activated Cl^- channels and, 728
kNBC1
bicarbonate secretion in pancreatic duct and, 382–84, 392
Knockouts
CLC channels in kidney and, 764–66
CLC Cl^- channels and, 790–92, 794–95, 797
estrogen biology and, 285–303
intestinal Na^+/H^+ exchange and, 420–22
intracellular calcium release channels and cardiac disease, 84

L

Lactalbumin
renal tubule albumin transport and, 577
lactoferrin gene
estrogen biology and, 296
Ladoga camilla
climate change and biophysical ecology, 189
Lamellar body
exocytosis of lung surfactant and, 595–612
surfactant protein C in conformational lung disease and, 673–74
LAT2-4F2hc transporter
renal amino acid transporters and, 565
Leaky channels
intracellular calcium release channels and cardiac disease, 69, 77, 82–83, 85
Lectins
colonic crypt transport and, 472
primary cilium physiology and, 525
Left-right axis asymmetry
primary cilium physiology and, 515–26
Left ventricular pressure (LVP)
calcium and thin filaments in cardiac contractility, 50–51
Leiurus quinquestriatis
Ca^{2+}-activated Cl^- channels and, 737
Lentiviruses
RNAi and, 155
Leptins
endocrinology of stress response and, 273
Leukemia-inhibitory factor (LIF)
estrogen biology and, 299–300
LG754
ligand control of coregulator recruitment to nuclear receptors and, 310
Li^+
IP_3 and Ca^{2+} signaling, 9–13, 16
Lif genes
estrogen biology and, 299–300
Ligand gating
CFTR chloride channels and, 701–12
Limulus spp.
IP_3 and Ca^{2+} signaling, 12
Lipid membrane damage sensors
cellular stress response

and, 231–33
Liposomes
exocytosis of lung surfactant and, 601
Liver
intestinal Na^+/H^+ exchange and, 418
Localization
CLC channels in kidney and, 761–62
intestinal Na^+/H^+ exchange and, 411–33
surfactant protein C in conformational lung disease and, 674–75
Locus ceruleus
endocrinology of stress response and, 263, 265–66, 268
Long-term depression (LTD)
IP_3 and Ca^{2+} signaling, 13, 17
Long-term potentiation (LTP)
IP_3 and Ca^{2+} signaling, 13
Long-term regulation
intestinal Na^+/H^+ exchange and, 430–32
Lower lethal temperatures
climate change and biophysical ecology, 190–91
LPA
intestinal Na^+/H^+ exchange and, 424
Luminal amino acid transporters
renal amino acid transporters and, 560–64
Luminal-binding partners
intracellular calcium release channels and cardiac disease, 74
Lung
blood flow regulation by red blood cells and, 103, 105, 136
surfactant protein C in conformational lung disease and, 663–87
Lung vascular development
alveolarization, 645–47
angiogenesis, 643–45
blood vessels, 624, 626–27
bronchial circulation, 624, 626–30
bronchopulmonary dysplasia, 637–49
conclusions, 649
growth factor signaling, 630–34, 643
introduction, 623–25
morphogenesis, 628–30, 634–37
oxygen tension regulation, 634–37
primate model, 649
pulmonary circulation, 624–30, 641–43
structure/function relationships, 624, 626–27
transcription factor signaling, 630–34
Luteinizing hormone (LH)
endocrinology of stress response and, 271
LY294002
renal tubule albumin transport and, 584
Lysosomes
CLC Cl^- channels and, 779, 790–91, 795–96
exocytosis of lung surfactant and, 595–612
renal tubule albumin transport and, 577, 579–82
surfactant protein C in conformational lung disease and, 684–86

M

Macromolecular damage
cellular stress response and, 225–47
Macromolecular signaling complexes
intracellular calcium release channels and cardiac disease, 69, 72–74, 78, 85
Macrophages
estrogen and progesterone signaling, 344–45
Macula densa
CLC channels in kidney and, 759, 773
Mad2 gene
estrogen biology and, 297
Male fertility
estrogen biology and, 293
Malnutrition
endocrinology of stress response and, 267
Mammalian systems
RNAi and, 147–62
Mammary gland
estrogen biology and, 285, 301–3
Mass exchange
climate change and biophysical ecology, 177–92
Mastoparan
exocytosis of lung surfactant and, 599
Maxi anion channels
CLC channels in kidney and, 759, 773
Mechanosensors
primary cilium physiology and, 515–26
Medullary cells
cell survival in renal medulla and, 531–45
Mefloquine
Ca^{2+}-activated Cl^- channels and, 737
Megalin
CLC channels in kidney and, 770

CLC Cl^- channels and, 793
renal tubule albumin transport and, 573, 576, 578–83
α-Melanocyte-stimulating hormone
endocrinology of stress response and, 259, 266
Membrane receptors
estrogen and progesterone signaling, 335–66
Mesocorticolimbic system
endocrinology of stress response and, 265
Meta-analysis
climate change and biophysical ecology, 177–92
Metabolic syndromes
endocrinology of stress response and, 269, 267, 276
Metabolism
biochemical adaptation and, 25, 27–28, 30, 32–33
cell survival in renal medulla and, 535
cellular stress response and, 245–46
comparative developmental physiology and, 212
endocrinology of stress response and, 259, 268, 271–72
intracellular calcium release channels and cardiac disease, 69
IP_3 and Ca^{2+} signaling, 10
renal amino acid transporters and, 566
Methanethiosulfonate (MTS) reagents
CFTR chloride channels and, 705–7
CLC channels and, 824–25, 829
Methyl xanthines
IP_3 and Ca^{2+} signaling, 4, 10
Microcirculation
blood flow regulation by red blood cells and, 99–36
Micropressure systems
comparative developmental physiology and, 215
microRNA
RNAi and, 147–49
Mimimal stress proteome
of all organismscellular stress response and, 226–31
Mineralocorticoids
colonic crypt transport and, 474
intestinal Na^+/H^+ exchange and, 424, 432–33
Miniaturization
comparative developmental physiology and, 215
MIP-2 factor
lung vascular development and, 648
Molecular evolution
cellular stress response and, 225–47
Molecular signaling
calcium and thin filaments in cardiac contractility, 51–58
Molecular switch
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Molecular targeting
RNAi and, 159
Momentum exchange
climate change and biophysical ecology, 177–92
Monocrotaline
lung vascular development and, 632
Monokines
lung vascular development and, 634
Monomeric channels
CFTR chloride channels and, 701
Motility
primary cilium physiology and, 517–18
MsrA protein
cellular stress response and, 227, 240–41
Multiphoton confocal microscopy
comparative developmental physiology and, 216
Muscarinic stimulation
salivary gland secretion mechanism and, 454, 459
Muscle
CLC channels and, 813–20
CLC Cl^- channels and, 779, 792, 796
intracellular calcium release channels and cardiac disease, 69–86
Myelin
exocytosis of lung surfactant and, 610–11
Myoglobin
blood flow regulation by red blood cells and, 109
myo-inositol
cell survival in renal medulla and, 539–40
Myosin
calcium and thin filaments in cardiac contractility, 40–41, 44, 46, 51, 53
intracellular calcium release channels and cardiac disease, 80
renal tubule albumin transport and, 578
Myotonia

CLC channels and, 809, 822
CLC Cl^- channels and, 782–84, 796
Mytilus edulis
climate change and biophysical ecology, 183, 186

N

Na^+
colonic crypt transport and, 471–85
Na^+-amino acid cotransport system B^0
renal amino acid transporters and, 560–64
NaCl
cell survival in renal medulla and, 531–45
CLC Cl^- channels and, 779, 787–90, 796
intestinal Na^+/H^+ exchange and, 412–13
Na^+/H^+ exchange
bicarbonate secretion in pancreatic duct and, 377, 380–81, 392
colonic crypt transport and, 475
molecular physiology and, 411–33
renal tubule albumin transport and, 582–83
Na^+, K^+-ATPase
bicarbonate secretion in pancreatic duct and, 386
cell survival in renal medulla and, 536–37
Nanotechnology
comparative developmental physiology and, 215
Necturus spp.
Ca^{2+}-activated Cl^- channels and, 721
Neomycin
colonic crypt transport and, 483
Neonates
lung vascular development and, 623–24, 637–49
Nephrogenic diabetes insipidus
CLC channels in kidney and, 759, 764–66
Nereocystis leutkeana
climate change and biophysical ecology, 185
NERK1 model
estrogen biology and, 295
NER proteins
cellular stress response and, 245
Nerve growth factor (NGF)
salivary gland secretion mechanism and, 446
neu gene
estrogen biology and, 301–2
Neural factors
calcium and thin filaments in cardiac contractility, 39
Neurological disorders
RNAi and, 161
Neurons
Ca^{2+}-activated Cl^- channels and, 719, 722–23
CLC Cl^- channels and, 779
endocrinology of stress response and, 260–62, 266, 270, 273
IP_3 and Ca^{2+} signaling, 1, 16–17
Neuropeptide Y (NPY)
endocrinology of stress response and, 273
Neurosteroids
estrogen and progesterone signaling, 346
NF-κB
lung vascular development and, 648
NHE genes
bicarbonate secretion in pancreatic duct and, 381, 383, 386, 392, 398–99
CLC Cl^- channels and, 793
intestinal water/Na absorption
actin cytoskeleton, 428–29
chronic acid-base changes, 432–33
chronic inflammation, 432–33
colon, 417
complexes, 426–28
congenital abnormalities in *SLC9As*, 432–33
duodenum, 416
esophagus, 416
functions, 415–16
gallbladder, 418
gene family, 413–15
GI tract localization of *NHE* 1–3, 416–18
glucocorticoids, 431–33
ileum, 417
intestinal Na absorption, 419–22, 431
jejunum, 417
knockout mouse models, 420–22
liver, 418
long-term regulation, 430–32
mineralocorticoids, 431–33
neutral NaCl absorption, 412–13
NHE1, 416–30
NHE2, 416–30
NHE3, 416–30
ontogeny of intestinal *NHE2* and *NHE3*, 418
phosphorylation, 429–30
regulation mechanisms, 425–26

short-term regulation of *NHE1–3*, 423–30
small intestinal resection, 431
stomach, 416
subcellular localization of *NHE1–3*, 418, 420
trafficking, 429
turnover, 429
salivary gland secretion mechanism and, 450
Nicotinic acetylcholine receptor
CLC Cl^- channels and, 779
Niflumic acid
bicarbonate secretion in pancreatic duct and, 389
Ca^{2+}-activated Cl^- channels and, 721, 724, 733, 737, 740
Nitric oxide (NO)
blood flow regulation by red blood cells and, 99–136
cell survival in renal medulla and, 534
intestinal Na^+/H^+ exchange and, 424
lung vascular development and, 631, 642, 646–47, 649
renal amino acid transporters and, 558
salivary gland secretion mechanism and, 457–58
Nitrite
blood flow regulation by red blood cells and, 126–27
S-Nitrosoglutathione (GSNO)
blood flow regulation by red blood cells and, 103–5, 128–30
S-Nitrosohemoglobin
blood flow regulation by red blood cells and, 99–136
Nkcc genes
bicarbonate secretion in pancreatic duct and, 386, 388, 396
colonic crypt transport and, 476–77
salivary gland secretion mechanism and, 449
NKX-2.1 transcription factor
lung vascular development and, 636
Nocodazole
bicarbonate secretion in pancreatic duct and, 382
renal tubule albumin transport and, 578
Nodal cilia
primary cilium physiology and, 517–18
Noise
retinal processing near absolute threshold and, 491–510
Non-epithelial amino acid transporters
renal amino acid transporters and, 567
Nongenotropic signaling
estrogen biology and, 299
Nonlinear microscopy
comparative developmental physiology and, 216
Non-selectivity
Ca^{2+}-activated Cl^- channels and, 730–31
Norepinephrine
Ca^{2+}-activated Cl^- channels and, 724
endocrinology of stress response and, 259, 268, 273–74
intestinal Na^+/H^+ exchange and, 424
lung vascular development and, 642
notched gene
lung vascular development and, 632–33
NPPB
bicarbonate secretion in pancreatic duct and, 388
Ca^{2+}-activated Cl^- channels and, 735–37, 740
Nuclear magnetic resonance (NMR)
calcium and thin filaments in cardiac contractility, 41, 43–44, 48
ligand control of coregulator recruitment to nuclear receptors and, 317
Nuclear receptors
estrogen and progesterone signaling, 335–66
ligand control of coregulator recruitment to
conclusions, 325
helix 12 dynamics, 321–23
indirect antagonism, 313–14
introduction, 309–10
ligand-independent activity, 320–21
mutational data, 321–23
partial agonists, 314
receptor subtype-specific signaling, 318–20
selective nuclear receptor modulators, 310–13
signaling across dimer interface, 314–18
transcription, 323–24
Nucleotide-binding domains (NBDs)
CFTR chloride channels and, 702–5, 709–10, 712

O

Obesity
endocrinology of stress

response and, 267, 269, 271, 273
Obligate athleticism
endocrinology of stress response and, 267, 273
Obligatory exchangers
heterodimeric
renal amino acid transporters and, 557
Obsessive-compulsive disorder
endocrinology of stress response and, 267, 273
Ocean
climate change and biophysical ecology, 177, 181–87
Ochratoxin A
renal tubule albumin transport and, 586
Off-target effects
RNAi and, 153–54
Okadaic acid
intestinal Na^+/H^+ exchange and, 424
Olfactory transduction
Ca^{2+}-activated Cl^- channels and, 720–21
Ontogeny
comparative developmental physiology and, 203–17
intestinal Na^+/H^+ exchange and, 418
Oocyte maturation
estrogen and progesterone signaling, 350–53
Opioids
endocrinology of stress response and, 274
Osmotic stress
cell survival in renal medulla and, 531–45
cellular stress response and, 229
Osteoporosis
endocrinology of stress response and, 268–69, 271–72
Ouabain
bicarbonate secretion in pancreatic duct and, 386
Ovary
estrogen and progesterone signaling, 354
estrogen biology and, 292–93, 298, 302
Oxidation
intracellular calcium release channels and cardiac disease, 74
Oxidoreductases
cellular stress response and, 227–28
Oxygen (O_2)
biochemical adaptation and, 30–31
blood flow regulation by red blood cells and, 99–136
cell survival in renal medulla and, 531–45
lung vascular development and, 634–37
Oxy-hemoglobin reaction
blood flow regulation by red blood cells and, 117–18
Oxytocin receptors
estrogen and progesterone signaling, 346–47

P

p21 gene
estrogen biology and, 296–97
PAI-1 inhibitor
lung vascular development and, 648
Palmitoylation
surfactant protein C in conformational lung disease and, 672
Panax ginseng
Ca^{2+}-activated Cl^- channels and, 739
Pancreas
estrogen and progesterone signaling, 344
Panic disorder
endocrinology of stress response and, 267, 269, 273
Parasympathetic nervous system
endocrinology of stress response and, 263, 265
Parathyroid hormone (PTH)
CLC Cl^- channels and, 793–94
intestinal Na^+/H^+ exchange and, 424
Partial agonists
ligand control of coregulator recruitment to nuclear receptors and, 314
PAT1 H^+-cotransporter
renal amino acid transporters and, 562
PDZ domains
CFTR chloride channels and, 706–8
Peripheral nervous system
endocrinology of stress response and, 259–77
Permeation
Ca^{2+}-activated Cl^- channels and, 730–34
CLC channels and, 809, 821, 823
Peroxiredoxin
cellular stress response and, 227, 240
Peroxisome proliferator activator receptor (PPAR)
ligand control of coregulator recruitment to nuclear receptors and, 310–19, 322–24
Personality disorders

endocrinology of stress response and, 276
pH
Ca^{2+}-activated Cl^- channels and, 739
bicarbonate secretion in pancreatic duct and, 377
renal tubule albumin transport and, 573, 580–83
4-Phenylbutyric acid (4-PBA)
surfactant protein C in conformational lung disease and, 686
Phorbol myristate acetate (PMA)
exocytosis of lung surfactant and, 602
intestinal Na^+/H^+ exchange and, 424
Phosphatases
intracellular calcium release channels and cardiac disease, 69, 73–74, 78–81
Phosphatidylinositol
IP_3 and Ca^{2+} signaling, 7–10, 12–13
Phosphatidylinositol 3-kinase (PI3K)
renal tubule albumin transport and, 573, 583, 585
6-Phosphogluconate dehydrogenase
cellular stress response and, 227
Phospholamban
calcium and thin filaments in cardiac contractility, 57–58
intracellular calcium release channels and cardiac disease, 79
Phospholipase C (PLC)
exocytosis of lung surfactant and, 603
Phosphorylation
Ca^{2+}-activated Cl^- channels and, 727–28, 739, 743
calcium and thin filaments in cardiac contractility, 39, 44, 47–48, 55, 57
cellular stress response and, 228, 243
CFTR chloride channels and, 701–2, 704, 707–8
estrogen and progesterone signaling, 355
intestinal Na^+/H^+ exchange and, 411, 423–27, 429–30
intracellular calcium release channels and cardiac disease, 69, 74–81, 85–86
renal tubule albumin transport and, 578, 584
salivary gland secretion mechanism and, 459
Phospho-STAT3 transcriptional activator
estrogen biology and, 299–301
Photon detection
retinal processing near absolute threshold and, 491–510
Photoperiodicity
climate change and biophysical ecology, 191
Photoreceptors
retinal processing near absolute threshold and, 491–510
Phototransduction
Ca^{2+}-activated Cl^- channels and, 722
retinal processing near absolute threshold and, 498–500
Physical limit
retinal processing near absolute threshold and, 491–510
Physiological ecology
climate change and biophysical ecology, 177–92
PI-PLC-IP_3 pathway
colonic crypt transport and, 483
Pisaster spp.
climate change and biophysical ecology, 183
Pituitary
estrogen biology and, 301–2
Plasma membrane
CLC Cl^- channels and, 779–97
exocytosis of lung surfactant and, 595–612
intestinal Na^+/H^+ exchange and, 411–33
IP_3 and Ca^{2+} signaling, 14–15
surfactant protein C in conformational lung disease and, 684
Plasticity
climate change and biophysical ecology, 186
comparative developmental physiology and, 208–10, 212–13
IP_3 and Ca^{2+} signaling, 17
Platelet-derived growth factor (PDGF)
lung vascular development and, 625, 633
PMCA-type pump
salivary gland secretion mechanism and, 456
pNBC1
bicarbonate secretion in pancreatic duct and, 383–84, 386, 392, 394–96, 398–99
Pneumocytes

type II
exocytosis of lung surfactant and, 595, 596–612
Pneumonitis
surfactant protein C in conformational lung disease and, 676–78, 686
Poisson noise
retinal processing near absolute threshold and, 491–510
Polarization
Ca^{2+}-activated Cl^- channels and, 719–43
CLC channels and, 817–20
intracellular calcium release channels and cardiac disease, 85
Polycystic kidney disease
primary cilium physiology and, 515, 519–20, 523
Polycystin
primary cilium physiology and, 515, 518–20, 522
Polyglutamine-induced neurological disorders
RNAi and, 161
Polymerase chain reaction (PCR)
bicarbonate secretion in pancreatic duct and, 381, 389
estrogen biology and, 297
salivary gland secretion mechanism and, 455
Polymorphisms
surfactant protein C in conformational lung disease and, 664–66
Polyspermy
Ca^{2+}-activated Cl^- channels and, 725–26
Population responses
climate change and biophysical ecology, 179–80
Pores
Ca^{2+}-activated Cl^- channels and, 733–34
CLC channels and, 811–12, 825–29
exocytosis of lung surfactant and, 595–12
Post-fusion phase
exocytosis of lung surfactant and, 603–4
Postnatal development
CLC channels in kidney and, 766–67
Post-translational processing
surfactant protein C in conformational lung disease and, 663–87
Potency
transcriptional
ligand control of coregulator recruitment to nuclear receptors and, 323–24
PP proteins
intracellular calcium release channels and cardiac disease, 80–82
ligand control of coregulator recruitment to nuclear receptors and, 319
Prefusion phase
exocytosis of lung surfactant and, 597–603
Pregnancy
endocrinology of stress response and, 267, 275
estrogen biology and, 302
Premature babies
lung vascular development and, 623–24, 637–49
Prenatal life
endocrinology of stress response and, 259
Primary cilium
background, 515–17
bone, 525
Ca^{2+} response, 522–23
cartilage, 525
centriole, 518–19
chemosensing, 524–25
conclusions, 526
flow sensing, 520–22
intraciliary transport, 519–20
mechanosensing in other tissues, 524
motility, 517–18
nodal cilia, 517–18
secretory cells, 525–26
Primed conformation
CFTR chloride channels and, 704
Prion-based diseases
RNAi and, 161
PRKO model
estrogen biology and, 288–92
Progesterone
estrogen biology and, 301–3
signal transduction pathway regulation and, 335–66
Prolactin
estrogen biology and, 301
Proliferating cell nuclear antigen (PCNA)
estrogen biology and, 296
Proline oxidase
cellular stress response and, 227
Propiomelanocortin (POMC)-derived peptides
endocrinology of stress response and, 259, 266, 270
proSP-C
surfactant protein C in conformational lung disease and, 674, 682
Prostaglandins
cell survival in renal medulla and, 532–34

Proteasomes
surfactant protein C in conformational lung disease and, 684
Protein C
lung vascular development and, 635
Protein damage sensors
cellular stress response and, 236–39
Protein kinase A (PKA)
bicarbonate secretion in pancreatic duct and, 383, 395
calcium and thin filaments in cardiac contractility, 44, 47, 54–55, 57
CFTR chloride channels and, 701–2, 704, 707–8
CLC channels in kidney and, 769
estrogen and progesterone signaling, 348, 350–51
intestinal Na^+/H^+ exchange and, 423
intracellular calcium release channels and cardiac disease, 69, 73–80, 82–83, 85–86
renal tubule albumin transport and, 573, 584–85, 587
salivary gland secretion mechanism and, 459–60
Protein kinase C (PKC)
bicarbonate secretion in pancreatic duct and, 389
calcium and thin filaments in cardiac contractility, 44, 47
CFTR chloride channels and, 702
estrogen and progesterone signaling, 348
exocytosis of lung surfactant and, 602–3
intracellular calcium release channels and cardiac disease, 84
IP_3 and Ca^{2+} signaling, 13
renal tubule albumin transport and, 573, 584–85, 587
Protein kinase G (PKG)
renal tubule albumin transport and, 584
Protein kinases
estrogen and progesterone signaling, 335–66
Proteinuria
renal tubule albumin transport and, 573–87
Proteomics
cellular stress response and, 225–31, 241
CLC channels in kidney and, 773
comparative developmental physiology and, 216
Proximal renal tubule
renal amino acid transporters and, 557–68
renal tubule albumin transport and, 585–86
PRX-1 gene
lung vascular development and, 634
Psychiatric disorders
endocrinology of stress response and, 259, 267, 273
Psychosocial short stature
endocrinology of stress response and, 267, 269
Psychosomatic diseases
endocrinology of stress response and, 276
Pulmonary alveolar proteinosis (PAP)
surfactant protein C in conformational lung disease and, 676–78
Pulmonary circulation
lung vascular development and, 623–24, 626–30
Pulmonary hypertension
blood flow regulation by red blood cells and, 115, 136
lung vascular development and, 623, 632, 639, 642–43, 646–47, 649
Putative oxidoreductase YIM4
cellular stress response and, 227
Pyrococcus furiosus
cellular stress response and, 226

Q

Quantum efficiency
retinal processing near absolute threshold and, 493–94, 498, 509
Quaternary structure
CFTR chloride channels and, 704–9
Quin 2 chelator
calcium and thin filaments in cardiac contractility, 43
Quinone oxidoreductase
cellular stress response and, 227

R

Raloxifene
ligand control of coregulator recruitment to nuclear receptors and, 311–13, 323
Rapamycin
intracellular calcium release channels and cardiac disease, 77
RAP protein
renal tubule albumin transport and, 581
Reabsorption
colonic crypt transport and, 471, 47–74, 485

Reactive oxygen species (ROS)
cellular stress response and, 228–29, 231, 239, 241, 246
lung vascular development and, 640
Receptor-mediated endocytosis
renal tubule albumin transport and, 573, 576–79, 583–85
Receptor subtype-specific signaling
ligand control of coregulator recruitment to nuclear receptors and, 318–20
Reciprocal regulation
salivary gland secretion mechanism and, 458
Red blood cells (RBCs)
blood flow regulation by red blood cells and, 99–136
Redox
blood flow regulation by red blood cells and, 123, 126
cellular stress response and, 225, 227–28, 230, 239–41
Regulated gene silencing
RNAi and, 152–53
Regulated ion secretion
colonic crypt transport and, 480–81
Relaxation
calcium and thin filaments in cardiac contractility, 54–55, 57
Release units
intracellular calcium release channels and cardiac disease, 79, 83–84
Renal amino acid transporters
axial heterogeneity, 558
$B^{0,+}$AT-rBAT heterodimeric exchanger, 562–63
B^0AT1 symporter, 560–62
basolateral amino acid transporters, 564–67
basolateral efflux, 564–66
conclusions, 567–68
EAAT3 (EAAC1) luminal Na^+-dependent cotransporter, 563–64
early kidney proximal tubule, 565–66
facilitated diffusion, 564–65
heterodimeric cystinuria transporter, 562–63
introduction, 557–58
limitations of characterization, 559–60
luminal amino acid transporters, 560–64
metabolism, 566
Na^+-amino acid cotransport system B^0, 560–62
neutral amino acids, 564–65
non-epithelial amino acid transporters, 567
PAT1 H^+-cotransporter, 562
perspectives, 567–68
SLC6A19 symporter, 560–62
small intestine basolateral membranes, 565–66
system L heterodimeric exchangers, 565–66
T-type amino acid transporter-1, 564–65
Renal medulla
cell survival in
acute adaptation, 536
adenosine, 534
betaine, 538–39
cell cultures, 545
chronic adaptation, 536–37
chronically hypoxic environment, 532–35
complication by simplification, 545
extracellular salt concentrations, 535–40
fluctuating extracellular salt concentrations, 540–41
free amino acids, 540
functional gene network, 542–44
GPC, 537–38
impaired adaptation, 544–45
introduction, 531
metabolism, 535
myo-inositol, 539–40
Na^+/K^+-ATPase, 536–37
nitric oxide, 534
oxygen tension, 532–35
prostaglandins, 532–34
sorbitol, 539
tonicity-induced DNA damage, 537
urea concentrations, 541–42
vasoconstrictors, 534–35
vasodilators, 534
Renal tubular epithelia
primary cilium physiology and, 515–26
Renal tubule albumin transport
albumin-binding sites, 579–80
albuminuria, 585–86
cell damage, 586–87
endosomal pH, 581–83
glomerular filtration, 574–79
introduction, 573–74
NHE-3, 582–83
pathophysiology, 585–86

proximal tubule, 585–86
receptor-mediated endocytosis, 576–85
signaling, 583–85
Reproduction
endocrinology of stress response and, 270–71
estrogen biology and, 285–303
Resection
small bowel
intestinal Na^+/H^+ exchange and, 431
Retinal processing
near absolute threshold
AII-to-cone bipolar synapse, 508–9
ambiguities in measurements, 495–96
behavior, 492–97, 500–1
conclusions, 509–10
cone bipolar-to-ganglion cell synapse, 508–9
false positives, 494–95
frequency of seeing experiments, 493–94
internal noise, 494–95
interneurons, 501–9
introduction, 491–92
noise, 494–95, 500–1
phototransduction, 498–500
retinal circuitry, 501–2, 504–9
retinal ganglion cells, 497–98, 500–1
rod noise, 500–1
rod-to-AII amacrine synapse, 507–9
rod-to-rod bipolar synapse, 502–7
summary, 497
Retinoic acid receptor (RAR)
ligand control of coregulator recruitment to nuclear receptors and, 310, 315–18, 320
Retinoid X receptor (RXR)
ligand control of coregulator recruitment to nuclear receptors and, 310–11, 314–18, 321, 325
Retrograde routing
surfactant protein C in conformational lung disease and, 684
Retroviruses
RNAi and, 155, 159, 161–62
Reverse transcriptase PCR (RT-PCR)
bicarbonate secretion in pancreatic duct and, 381, 389
estrogen biology and, 297
Rhodopsin
retinal processing near absolute threshold and, 492, 499–500, 502, 505, 509
RISC complex
RNAi and, 150
RNA interference (RNAi)
animal models, 154–56, 159–60
biochemistry, 149
biology, 148–50
co-opting endogenous RNAi machinery, 149–50
delivery routes for RNAi-based therapeutics, 161–62
development, 148–49
disease, 148–49, 154–56, 159–60
experimental animals, 155
experimental tool, 150–54
gene silencing, 150–53
genetic screens, 156–59
human therapy, 159–62
induction, 151, 154–55
interferon, 153–54
introduction, 147–48
in vitro delivery, 154
limitations, 153–54
lower organisms, 156–57
mammalian systems, 150–52, 157–59
normal tissue physiology, 148–49, 154–56
novel mechanism, 148–49
off-target effects, 153–54
primary cells, 155
prospects, 162
regulated gene silencing, 152–53
shRNA, 151–52
siRNA, 150–51, 154–55
stable induction, 151–52
summary, 162
therapeutic strategy, 159–61
tissues, 155
tissue-specific gene silencing, 152–53
transgenic animal models, 155–56
viral vectors, 155
Rocky intertidal zone
climate change and biophysical ecology, 177, 181–87
Rod photoreceptors
retinal processing near absolute threshold and, 491–510
Rosiglitazone
ligand control of coregulator recruitment to nuclear receptors and, 322
r selection
comparative developmental physiology and, 209
RU486
estrogen and progesterone signaling, 352, 354
Ryanodine receptors (RyR)
intracellular calcium release channels and cardiac disease, 69, 71–79, 81–83, 85–86

IP_3 and Ca^{2+} signaling, 14–15
primary cilium physiology and, 523
salivary gland secretion mechanism and, 455, 458, 460

S

Saccharomyces cerevisiae
cellular stress response and, 226, 230, 235, 242
RNAi and, 148
Salivary gland acinar cells
regulation of fluid and electrolyte secretion in
Ca^{2+}, 454–58
Cl^-, 446–47
cross-talk, 458–60
future research, 460–61
introduction, 445–46
ion transport, 44–53
mechanism, 446–53
regulation, 453–60
signaling, 458–60
water transport, 448–53
Salivary glands
IP_3 and Ca^{2+} signaling, 1–6, 8, 10, 15
Salmonella typhimurium
CLC channels and, 809
colonic crypt transport and, 482
Sarcomere
calcium and thin filaments in cardiac contractility, 39–51, 53, 55–56, 58
Sarcoplasmic reticulum
intracellular calcium release channels and cardiac disease, 69, 77–79, 82–84
SARS coronavirus
RNAi and, 160–61
Scaffolds
intracellular calcium release channels and cardiac disease, 69
Scaling
comparative developmental physiology and, 211–12
Scopimera inflata
comparative developmental physiology and, 210
Scotopic vision
retinal processing near absolute threshold and, 491–510
Sea surface temperature
climate change and biophysical ecology, 181–84
Second messengers
IP_3 and Ca^{2+} signaling, 4–10, 12
Secretin
bicarbonate secretion in pancreatic duct and, 377–78, 381–82, 384–85, 389–90, 395
Secretory diarrhea
colonic crypt transport and, 471–72, 476, 481–83, 485
SelB protein
cellular stress response and, 227
Selective nuclear receptor modulators (SNRMs)
ligand control of coregulator recruitment to nuclear receptors and, 310–13
Selectivity
Ca^{2+}-activated Cl^- channels and, 719, 730–34
Semibalanus spp.
climate change and biophysical ecology, 182
Sensory transduction
Ca^{2+}-activated Cl^- channels and, 719–43
Sepsis
blood flow regulation by red blood cells and, 99, 115, 136
SERCA pumps
salivary gland secretion mechanism and, 456
Serotonin
intestinal Na^+/H^+ exchange and, 424
Serum response factor (SRF)
lung vascular development and, 633
Sex steroid hormones
estrogen and progesterone signaling, 335–66
Sexual abuse
childhood
endocrinology of stress response and, 267
SFTPC genes
surfactant protein C in conformational lung disease and, 664–69, 677–78
SGLT1 cotransporter
renal amino acid transporters and, 558
Shigella flexneri
colonic crypt transport and, 482
Shore communities
climate change and biophysical ecology, 184–87
Short-chain fatty acids (SCFAs)
intestinal Na^+/H^+ exchange and, 424
Short-term regulation
intestinal Na^+/H^+ exchange and, 423–30
shRNA
RNAi and, 147–48, 151–52
Sickle cell disease
blood flow regulation by red blood cells and, 99, 115, 136
Signaling

blood flow regulation by red blood cells and, 99–136
Ca^{2+}-activated Cl^- channels and, 719–43
calcium and thin filaments in cardiac contractility, 39–58
cell survival in renal medulla and, 531–45
cellular stress response and, 228, 230
comparative developmental physiology and, 212
estrogen biology and, 285–303
estrogen and progesterone signaling, 335–66
intracellular calcium release channels and cardiac disease, 69, 72–74, 78, 85
IP_3 and Ca^{2+} signaling, 1–17
ligand control of coregulator recruitment to nuclear receptors and, 309–25
lung vascular development and, 630–37, 643
primary cilium physiology and, 515–26
renal tubule albumin transport and, 573, 583–85
retinal processing near absolute threshold and, 491–510
salivary gland secretion mechanism and, 445–61
surfactant protein C in conformational lung disease and, 674
sim genes
lung vascular development and, 635
Single nucleotide polymorphisms (SNPs)
surfactant protein C in conformational lung disease and, 665
Single-site model
bicarbonate secretion in pancreatic duct and, 397–99
siRNA
RNAi and, 147–48, 150–52, 154–55
SITS
bicarbonate secretion in pancreatic duct and, 382, 390
Ca^{2+}-activated Cl^- channels and, 735–37
SLC genes
bicarbonate secretion in pancreatic duct and, 377, 391–94, 396–99
intestinal Na^+/H^+ exchange and, 411–33
renal amino acid transporters and, 557, 560–62
salivary gland secretion mechanism and, 449–50
Sleep apnea
endocrinology of stress response and, 271
SLO genes
salivary gland secretion mechanism and, 453
Slow gating
CLC channels and, 814–17
Small intestinal resection
intestinal Na^+/H^+ exchange and, 431
Small intestine basolateral membranes
renal amino acid transporters and, 565–66
"Smart dust"
comparative developmental physiology and, 215
Smooth muscle contraction
Ca^{2+}-activated Cl^- channels and, 723–24
SNAP proteins
exocytosis of lung surfactant and, 601
SNARE proteins
exocytosis of lung surfactant and, 601
SNO-hemoglobin
blood flow regulation by red blood cells and, 99–136
SOC channels
salivary gland secretion mechanism and, 456, 458, 460
Somatostatin
endocrinology of stress response and, 269
intestinal Na^+/H^+ exchange and, 424
primary cilium physiology and, 524
Sorbitol
cell survival in renal medulla and, 539
Sorcin
intracellular calcium release channels and cardiac disease, 74
Species range limits
climate change and biophysical ecology, 181–87
Specificity
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Sperm cell acrosome reaction
estrogen and progesterone signaling, 347–50
Sphinophilin
intracellular calcium release channels and cardiac disease, 82
Spinocerebellar ataxia type 1

RNAi and, 161
Stable induction
RNAi and, 151–52
Starling's law
calcium and thin filaments in cardiac contractility, 56
STAS domains
CFTR chloride channels and, 712
Steric mechanisms
calcium and thin filaments in cardiac contractility, 39
Steroid hormones
ligand control of coregulator recruitment to nuclear receptors and, 309–25
Steroid receptors
nuclear
estrogen and progesterone signaling, 335–66
Stomach
intestinal Na^+/H^+ exchange and, 416
Streptomyces coelicolor
cellular stress response and, 238, 244
Stress response
cell survival in renal medulla and, 531–45
climate change and biophysical ecology, 177–92
endocrinology of
adaptive responses, 264–65
adrenomedullary response, 263, 265
amygdala-hippocampus complex, 265–66
appetite regulation, 266
arginine vasopressin, 260–62
catecholaminergic neurons, 260–62
chronic hyperactivation, 266–75
chronic hypoactivation, 274–75
CNS components, 265–66
conclusions, 277
corticotropin-releasing hormone, 260–62
development, 267–69, 275–77
environment, 275–77
gastrointestinal function, 272
genetics, 275–77
growth, 267–69
hypothalamic-pituitary-adrenal axis, 262–63
immune function, 272–75
introduction, 259–60
LC/NE system, 263–65
mesocorticolimbic system, 265
metabolism, 271–72
neuroendocrine effectors, 260
parasympathetic nervous system, 263, 265
POMC neuronal system, 266
psychiatric disorders, 273
reproduction, 270–71
sympathetic nervous system, 263, 265
temperature regulation, 266
thyroid function, 269–70
molecular and evolutionary basis of, 225–47
surfactant protein C in conformational lung disease and, 683
Striated muscle
intracellular calcium release channels and cardiac disease, 69–86
Structure/function relationships
CLC channels and, 809, 822–29
intracellular calcium release channels and cardiac disease, 71–74
surfactant protein C in conformational lung disease and, 664–66
SU5416
lung vascular development and, 646–47
Subcellular localization
intestinal Na^+/H^+ exchange and, 418, 420
Subcellular targeting
estrogen and progesterone signaling, 357
Substance abuse
endocrinology of stress response and, 269, 273, 276
Substance P
bicarbonate secretion in pancreatic duct and, 390
Substituted cysteine accessibility approaches
CLC channels and, 824–25
Succinate semialdehyde dehydrogenase
cellular stress response and, 227
Sucrose velocity gradient
CFTR chloride channels and, 707
Supercooling points
climate change and biophysical ecology, 190–91
Superoxide dismutase (SOD)
blood flow regulation by red blood cells and, 121
cellular stress response and, 227, 240

lung vascular development and, 640
SUR1 sulfonylurea receptor
CFTR chloride channels and, 708–9
Surface cells
colonic crypt transport and, 471–85
Surface tension
exocytosis of lung surfactant and, 595–612
Surface transport
colonic crypt transport and, 472–73
Surfactant protein C (SP-C)
biosynthesis and conformational lung disease
amyloidogenesis, 685
apoptosis, 683–84
biosynthesis, 671–86
bitopic type II integral membrane protein, 671–72
BRICHOS domain, 675–76, 679
caspase activation, 683–84
cell survival pathways, 683–84
cellular machinery for SP-C biosynthesis, 669–71
coexpression of *SP-C* mutants, 681
conclusions, 686–87
cytoplasmic domains, 678
degradation, 683
diversion to constitutive secretory pathway/plasma membrane, 684
dominant-negative effect, 681
endoplasmic reticulum, 671–72, 683
endosomes, 684–85
expression analysis, 679–80
functional signal peptide, 674
gain of function, 680–81
gene expression, 685
genomics, 664–66
Group A mutations, 675–76, 679
Group B mutations, 677–78
Group C mutations, 678, 680
higher-order structures, 667–69
homomeric association, 675
immunomodulation, 681–82
inhibition of normal biosynthesis, 681
interstitial lung disease, 675, 679–81
intracellular sites of cleavage, 672–73
introduction, 663–64
lamellar body compartment, 673–74
localization of targeting motifs, 674–75
lysosomes, 684–85
mature SP-C, 667–69
mechanisms of SP-C lung injury, 682
mediators of SP-C lung injury, 682
molecular strategies to modulate SP-C mutant-induced lung disease, 685–86
mutants, 678–81
non-BRICHOS COOH domain, 677–78, 680
non-surfactant function, 681–82
overview, 678–79
palmitoylation, 672
polymorphisms, 664–66
primary sequence, 667–69
processing enzymes, 673–74
proprotein folding, 672
proSP-C, 674
protein aggregation/accumulation in foreign compartments, 684–85
regulated cleavage events, 672
retrograde routing to cytosolic proteasome, 684
SFTPC, 664–69
sorting, 674–75
$SP\text{-}C_{3.7}$, 681–82
stress, 683
structure/function relationships, 664–66
therapy prospects, 685–86
toxicity, 680–81
trafficking, 674–75
translation, 682
translocation, 671–72
unanswered questions, 686–87
unfolded protein response, 683
Survival
cell survival in renal medulla and, 531–45
surfactant protein C in conformational lung disease and, 683–84
Sympathetic nervous system
endocrinology of stress response and, 263, 265
Synapses
CLC Cl^- channels and, 779, 790–92, 795–96
retinal processing near absolute threshold and, 501–9

Synaptobrevin
exocytosis of lung surfactant and, 601
Synexin
exocytosis of lung surfactant and, 601
Syntaxin
exocytosis of lung surfactant and, 601
System L heterodimeric exchanger
renal amino acid transporters and, 565–66
Systole
calcium and thin filaments in cardiac contractility, 51, 53–54, 56–57
intracellular calcium release channels and cardiac disease, 78–79

T

Tamoxifen
Ca^{2+}-activated Cl^- channels and, 737
ligand control of coregulator recruitment to nuclear receptors and, 310–13, 321–23
Taste transduction
Ca^{2+}-activated Cl^- channels and, 721
Tegula spp.
climate change and biophysical ecology, 183
Temperature
biochemical adaptation and, 25, 27–28
climate change and biophysical ecology, 190–91
comparative developmental physiology and, 212
endocrinology of stress response and, 266
Terbutaline
exocytosis of lung surfactant and, 603
Testosterone
endocrinology of stress response and, 271
Tethering
estrogen biology and, 295, 299
Tetraclita spp.
climate change and biophysical ecology, 183
Tetraethylammonium (TEA)
bicarbonate secretion in pancreatic duct and, 385–86
Tg737 gene
primary cilium physiology and, 519
tgo genes
lung vascular development and, 635
Thalassemia
blood flow regulation by red blood cells and, 136
Thalidomide
lung vascular development and, 645
Thapsigargin
colonic crypt transport and, 483
salivary gland secretion mechanism and, 457
THC
ligand control of coregulator recruitment to nuclear receptors and, 313, 315, 319–21, 324
Theophylline
IP_3 and Ca^{2+} signaling, 6
Thin filaments
calcium and thin filaments in cardiac contractility, 39–58
Thiols
blood flow regulation by red blood cells and, 108, 121–24, 130, 135
Thioredoxin
cellular stress response and, 227, 240
Thrombin
intestinal Na^+/H^+ exchange and, 424
Thyroid
endocrinology of stress response and, 267–70, 273–74
ligand control of coregulator recruitment to nuclear receptors and, 310–11, 314–17
Tides
climate change and biophysical ecology, 181–87
Tie receptor
lung vascular development and, 630–31
Tissue-specific gene silencing RNAi and, 152–53
Tonicity-induced DNA damage
cell survival in renal medulla and, 537
Torpedo spp.
CLC channels and, 810, 813, 815, 824
CLC channels in kidney and, 761
CLC Cl^- channels and, 780, 782
Trafficking
intestinal Na^+/H^+ exchange and, 411, 420, 429–30
surfactant protein C in conformational lung disease and, 674–75
Trait-mediated interactions
climate change and biophysical ecology, 179
Transcriptional coregulator proteins

nuclear receptors and, 309–25
Transcription factor signaling
lung vascular development and, 630–34
Transepithelial transport
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
Transferrin
intestinal Na^+/H^+ exchange and, 418
renal tubule albumin transport and, 577
Transforming growth factor β (TGFβ)
lung vascular development and, 625, 633, 636, 641, 643, 645
renal tubule albumin transport and, 573, 586
Transgenes
blood flow regulation by red blood cells and, 128
calcium and thin filaments in cardiac contractility, 39, 52, 55–57
estrogen biology and, 285–303
RNAi and, 155–56
surfactant protein C in conformational lung disease and, 686
Transient fusion
exocytosis of lung surfactant and, 604
Transient receptor potential (TRP) channel superfamily
exocytosis of lung surfactant and, 599
primary cilium physiology and, 522
Translation
surfactant protein C in conformational lung disease and, 682
Translocation
surfactant protein C in conformational lung disease and, 671–72
Transmembrane domains
CFTR chloride channels and, 704–7, 709–11
Transport
CFTR chloride channels and, 701–12
CLC channels and, 829–31
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
colonic crypt transport and, 471–85
primary cilium physiology and, 519–20
renal amino acid transporters and, 557–68
renal tubule albumin transport and, 573–87
salivary gland secretion mechanism and, 445–61
trh gene
lung vascular development and, 635
Triadin
intracellular calcium release channels and cardiac disease, 74, 79
Trifluoroperazine
Ca^{2+}-activated Cl^- channels and, 728
Trimethylamine oxide (TMAO)
surfactant protein C in conformational lung disease and, 686
Tropomyosin
calcium and thin filaments in cardiac contractility, 39, 48–49
intracellular calcium release channels and cardiac disease, 80
Troponins
calcium and thin filaments in cardiac contractility, 39, 41–48
trp genes
salivary gland secretion mechanism and, 457
T-type amino acid transporter-1
renal amino acid transporters and, 564–65
Tubulo-glomerular feedback
CLC channels in kidney and, 759–73
Tubulo-interstitial diseases
renal tubule albumin transport and, 573
Tumor necrosis factor α (TNFα)
endocrinology of stress response and, 270
lung vascular development and, 639, 641
tweety gene
Ca^{2+}-activated Cl^- channels and, 742
Two-site model
bicarbonate secretion in pancreatic duct and, 396–97

U

Unfolded protein response
surfactant protein C in conformational lung disease and, 683
Unidirectional efflux transporters
renal amino acid transporters and, 557
Universal mechanism
cellular stress response and, 225–47
Universal mechanisms
comparative developmental physiology and, 213–15

Upper lethal temperatures
climate change and biophysical ecology, 190–91
Urea
cell survival in renal medulla and, 531–45
CLC channels in kidney and, 765
Ureaplasma urealyticum
lung vascular development and, 641
Urine production
cell survival in renal medulla and, 531–45
Uterus
estrogen biology and, 285, 298

V

Vascularity
blood flow regulation by red blood cells and, 127
Ca^{2+}-activated Cl^- channels and, 719
lungs and, 623–49
Vascular endothelial growth factor (VEGF)
lung vascular development and, 630–34, 643–49
Vasoactive intestinal peptide (VIP)
salivary gland secretion mechanism and, 458–59
Vasoconstriction
cell survival in renal medulla and, 534–35
Vasodilation
blood flow regulation by red blood cells and, 99–136
cell survival in renal medulla and, 534
Vasopressin
exocytosis of lung surfactant and, 599
Vasoregulation
blood flow regulation by red blood cells and, 99–136
Ventilator-associated lung injury
lung vascular development and, 640–41
Vibrio cholerae
colonic crypt transport and, 482
Vicia faba
Ca^{2+}-activated Cl^- channels and, 719
Viral vectors
RNAi and, 147, 153, 155, 159–61
Visual sensitivity
retinal processing near absolute threshold and, 491–510
Vitamin A
lung vascular development and, 641
Vitamin D_3
CLC Cl^- channels and, 793–94
ligand control of coregulator recruitment to nuclear receptors and, 310–14, 317
Vitamin E
lung vascular development and, 641
Voltage gating
CLC channels and, 813–29
CLC Cl^- channels and, 779, 792
exocytosis of lung surfactant and, 599
intracellular calcium release channels and cardiac disease, 78
Volume regulation
calcium and thin filaments in cardiac contractility, 51
CLC Cl^- channels and, 779

W

Waste materials
colonic crypt transport and, 471–85
Water channels
bicarbonate secretion in pancreatic duct and, 386
Ca^{2+}-activated Cl^- channels and, 719–43
CLC channels in kidney and, 759–73
CLC Cl^- channels and, 779–97
colonic crypt transport and, 471–85
intestinal Na^+/H^+ exchange and, 411–33
salivary gland secretion mechanism and, 445, 448–53
Waves
climate change and biophysical ecology, 184–87
Whole-body ionic homeostasis
colonic crypt transport and, 485
WNK4 kinase
bicarbonate secretion in pancreatic duct and, 395–96
Wnt genes
estrogen biology and, 301
lung vascular development and, 632
Wortmannin
renal tubule albumin transport and, 584
Wyeomyia smithii
climate change and biophysical ecology, 191

X

Xanthine derivatives
exocytosis of lung

surfactant and, 603
Xenopus laevis
bicarbonate secretion in pancreatic duct and, 379, 387, 389, 391
Ca^{2+}-activated Cl^- channels and, 719, 725, 727, 730–31, 735, 737–40
CFTR chloride channels and, 705–6, 708
CLC channels and, 813
CLC channels in kidney and, 762–63, 767–68
CLC Cl^- channels and, 783, 788, 791, 793
estrogen and progesterone signaling, 350–52
IP_3 and Ca^{2+} signaling, 15, 16
primary cilium physiology and, 524
renal amino acid transporters and, 560, 562–65
X-PR
estrogen and progesterone signaling, 351
X-ray crystallography
blood flow regulation by red blood cells and, 101, 128, 130
calcium and thin filaments in cardiac contractility, 41–42, 46–48, 52
CLC channels and, 811–12, 824, 831
ligand control of coregulator recruitment to nuclear receptors and, 319–20, 322

Y

y^+LAT2-4F2hc transporter
renal amino acid transporters and, 566
Yeast
cellular stress response and, 226, 230, 235, 242
RNAi and, 148
salivary gland secretion mechanism and, 446

Z

ZK98299
estrogen and progesterone signaling, 354
ZNF9 gene
Cl^- channels and, 784